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## Volume II--Descriptions of Programs


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## Volume II- Descriptions of Programs

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**PROGRAM NAME:** ADDF
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc can be used to add or subtract several disk image files, pixel by pixel, according to the following general equation:

OUT = C + sum[ W(n)*I(n)**E(n) ] for n = 1 to NUM (1)

where OUT is the output data file designated by the parameter OUT_FILE, C corresponds to the constant CONST, W are the weights WEIGHT, I are the image data from the files IN_FILES, E are the exponents EXPON, and NUM is the number of IN_FILES. The region of interest within the image may be limited by specifying a blotch plane (BPLANE and BLO_FILE). One can limit the arithmetic only to the areas within or outside of this blotch. ADDF converts the integer numbers of IN_FILES to floating point for its arithmetic operations and hence maintains excellent accuracy. Consequently, OUT_FILE is used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. For a given pixel, if any I(n) value falls outside the RANGE values, or if an arithmetic error occurs during summation, OUT for that pixel will be flagged as "invalid" and subsequently assigned a value that is specified in the proc STATDIS.

**PARAMETERS:**

(1) IN_FILES are the names of the disk resident input image files one wants to process (the I(n) in equation (1) above). The extension ".IMG" will be used by default if it is omitted from a file name. The number of names entered must be the same as the number of WEIGHT's and EXPON's. The files must be image data files such as those produced by the procs TODISK and STATDIS (i.e., they contain 513 blocks, one of which is a header block). The files must also be for images of the same type of data (see the description for MODE).

(2) WEIGHT are the weighting factors for IN_FILES. A number must be entered for each IN_FILES to be summed. Each number will be used as a multiplicative factor for the pixel values of its corresponding image (raised to the EXPON power) during summation. Equation (1) above shows how W(n) or WEIGHT multiplies the input images. To illustrate the use, consider the following examples:

1) for simple summation, set C=0, W(n)=1, and E(n)=1;
2) to raise a single image (NUM=1) to the 3rd power, set C=0, W(1)=1, and E(1)=3;
3) to subtract image 2 from image 1, set=0, W(1)=E(1)=E(2)=1, and W(2)=-1.

(3) EXPON are the exponents for IN_FILES. A number must be entered for each IN_FILES to be summed. Each number will be used as the power by which to raise the pixel values of its corresponding image during summation. Equation (1) above shows how E(n) or EXPON raises the image to a power. Note that EXPON's not equal to one will affect the units of their respective terms. It is the user's responsibility to ensure that the final units of terms are consistent. Arithmetic errors may occur during summation if inappropriate EXPON values are used. For example, errors will occur if EXPON's are too large or too small, or if negative EXPON's are used with zero or negative input image pixel values. Output data values of pixels for which arithmetic errors have occurred will be flagged as "invalid" and may be assigned any desired value when using the proc STATDIS. (See the documentation for the proc STATDIS dealing with the parameter INVAL for further information). Such pixels cannot be distinguished from those flagged as "invalid" because of range restrictions which are described later. ADDF will display the number of pixels with such errors, if any have occurred, at the end of its processing. With the use of an appropriate blotch or values for RANGE, these pixels may be excluded from the calculations. However, these arithmetic errors may indicate that your values for EXPON and other input parameters are incorrect and should be changed.

(4) CONST is a constant (in output data units) which is to be added to the sum of the terms as shown in equation (1). The user should enter a real number whose units match those of the other terms.

(5) MODE is a flag which indicates whether the pixel values of the IN_FILES image(s) represent data (such as temperature or radiance) that are linearly related to gray levels, or pigment concentrations which are non-linear. A "1" should be entered for linear data and a "2" for pigment data.

(6) FACTOR is a linear scale factor used only if MODE=1, i.e. when a linear data-to-gray scale mapping function for the IN_FILES image(s) is used. If non-zero, it will represent the factor by which to divide the gray values of IN_FILES pixels in order to convert them into actual data values; if zero, the slope and intercept for this mapping function will be obtained from each file header of the IN_FILES disk image files. In order to retain the gray values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(7) RANGE defines the range of IN_FILES pixel values to use for the summation in equation (1). The user should enter two values in the input data units. For a given pixel location, if a value for any IN_FILES falls outside the RANGE values, the corresponding pixel in OUT_FILE will be flagged as "invalid." These "invalid" pixels may be assigned any value when using STATDIS to generate the image from OUT_FILE. Again, the RANGE values must conform to the units of the

IN_FILES image(s) as specified by MODE and FACTOR (i.e. pigment concentration or units linearly proportional to gray levels). For example, to exclude only land and cloud pixels, the RANGE values should be 1.0 and 254.0 (the default values) for gray levels (MODE=1 and FACTOR=1) or 0.0425 and 39.0 for pigment concentrations (MODE=2).

(8) OUT_FILE is the name for the "data" file output to the disk. This file is composed of floating point numbers for higher accuracy. The extension ".DAT" will be used by default if it is omitted from the file name. OUT_FILE may be used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. Note, however, that the same blotch specification used in ADDF will be needed by STATDIS (i.e., the same blotch must be used unless BPLANE=0). "Data" files such as OUT_FILE cannot be dropped directly into the image display unit as images or used as input to this proc. STATDIS must be used to generate and save image files from "data" files. In this way, you can interactively obtain, using STATDIS, an optimum gray scale for the image file corresponding to the range or subrange of data values in the "data" file. By convention, "data" file names end with the extension ".DAT" whereas image file names end with ".IMG". Note that the disk space required by a "data" file is proportional to the blotch area and may be much more than that required by an image file which is always 513 blocks. For a full image (BPLANE=0, the equivalent of a full-image blotch), a "data" file will require 2049 blocks or about four times the space of an image file; for a blotch covering less than a quarter of the image, however, the "data" file will be smaller than an image file.

(9) BPLANE defines the number of the graphics plane containing the blotch area(s) of interest and is in the range -7 to 7. If the number entered is positive, pixels within the blotch will be considered. If the number is negative, pixels outside the blotch will be considered. Only blotches defined on this plane (the absolute value of BPLANE) of the blotch file BLO_FILE will be used. If "0" is entered, the entire image area (512 x 512) will be used and BLO_FILE will be ignored.

(10) BLO_FILE is the name of the blotch file which defines the image area(s) of interest unless BPLANE = 0. Only blotches defined on the plane corresponding to BPLANE will be used. Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. The extension ".BLO" will be used by default if it is omitted from the file name.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** ALLOC
**DATE:** 4/15/91
**MENU:** INITIAL

**DESCRIPTION:** This proc allocates an IIS to the user and must be executed before using any proc's which access the IIS.

**PARAMETERS:**
(1) UNIT is the parameter that identifies which IIS is being allocated to the user. The parameter takes as input either ATLANTIC or PACIFIC, the names of the two IIS's at the OCF.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** ANGST
**DATE:** 4/15/91
**MENU:** ATMOS

**DESCRIPTION:** ANGST provides an alternative method to CLRWAT for estimating the Angstrom exponents required for removing aerosol radiance from a CZCS level-1 scene. The technique is based on Arnone and LaViolette (1984) and allows the user to interactively select the Angstrom exponent for the aerosol correction, correct the image and read the resulting subsurface water radiance values. Thus, the user can visually correct a scene which may not have clear water or has distinct haze bands. When the aerosols have sharp structure, the Angstrom exponent can be increased until the structure disappears. The haze will appear as bright areas in the undercorrected scene. But if the scene is overcorrected, the structure will become darker than adjacent clear areas.

The correction is performed on each of channels 1 through 3 independently rather than simultaneously as in CLRWAT. Thus, the program requires that the level 1 radiance images from any or all of channels 1, 2 or 3 and channel 4 be loaded in refresh memories. Channel 4 must be loaded since the aerosol correction is based on the residual radiance in channel 4 after it has had the Rayleigh component removed.

Once the program is initiated, it removes the Rayleigh radiance from the level-1 data. After this is accomplished, the user may change the Angstrom exponent by a horizontal translation of the cursor using the trackball. Button A3 is used when a correction is to be made.

One approach to using ANGST is to follow some of the procedures in the "clear-water" radiance algorithm which is applied in CLRWAT. First, correct channels 2 and 3 remembering that the Angstrom exponent in channel 2 is $\geq$ the Angstrom exponent in channel 3, and then average the Angstrom exponents in channels 2 and 3 and apply that value to channel 1.

**PARAMETERS:**

(1) IMGCHN is the refresh memory where the first level 1 radiance scene to be corrected is loaded.

(2) REFCHN is the refresh memory where the channel 4 level 1 radiance scene is loaded.

(3) CORR is the index of the correction method to use for calculating total radiances:
   1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
   2: Use correction factors specified by FACTOR.

(4) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(5) GPLANE is the graphics plane used to mark the location of cursor (Button A1).

(6) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(7) ANGRE values are minimum and maximum Angstrom exponent values. The values set the range of values that can be applied for the aerosol correction and correspond to the extreme right side of the screen and extreme left side of the screen, respectively, when moving the cursor horizontally to select an Angstrom exponent.

(8) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(9) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | | F |
|---|---|---|---|---|---|---|
| 3 | Display Angstrom Value | Process Another Channel | Read Water Radiance Value | Feed to Refresh Memory | | Exit |
| 2 | Process Water Radiance | Change Calibration | Stretch Image at Display | Display Values | | |
| 1 | Mark Box | View Another Channel | | | | |

A3: Used to switch from any other button operation to the mode where the Angstrom exponent can be changed by moving the cursor. The value is output to the terminal monitor as the trackball is moved. This mode is automatically entered after the program finishes with the Rayleigh correction of the image.

A2: Used to apply the aerosol correction for the current Angstrom exponent.

A1: Used to mark the cursor box location when reading water radiance values (Button C3).

B3: Used to switch to a different image loaded in another refresh memory. The program will prompt the user for the IMGCHN.

B2: Used to redefine the calibration parameters, CORR and FACTOR. Once these are input the sequence repeats by recomputing the total radiance and subtracting the Rayleigh radiance.

B1: Used to simply display another refresh memory without operating on it. It is sometimes useful to view the uncorrected image and/or channel 4 in order to identify the structure in the aerosol field. Once this option is selected, a new button menu with only B1 and F3 defined will be displayed. Use B1 again to view another channel or return to the original channel.

C3: Used to read water radiance values. The cursor will change to a box which can be used to roam the corrected scene.

C2: Used to enhance the contrast of the corrected scene in order to determine more clearly the structure in the scene. To return to the original correction, use A3 and A2.

D3: Used to save a corrected scene. Feed the scene to an unneeded refresh memory where it can be saved to disk using TODISK after exiting ANGST.

D2: Used to output solar and spacecraft zenith and azimuth angles used in the Rayleigh scattering computations. Additional information output are the subsurface 'clear water' radiances that correspond to the solar zenith angle at the cursor location. If the scalar multiple scattering algorithm is being used, the ratio of multiple to single scattering is also output.

F3: Used to exit ANGST.

**PROGRAM NAME:** ANNOTATE
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** The proc ANNOTATE writes characters/symbols to a user selected refresh memory of the IIS or to a graphics bit plane. The user also specifies the size of the characters, where and how they will be placed on the screen, and the colors of the characters and the background behind them. Even after the proc has been initiated, the annotation will not be written to the screen until the A3, "ANNOTATE", button is pressed on the IIS button keypad.

**PARAMETERS:**
(1) CHANNEL is the number of the refresh memory in which to write annotation. To use the graphics planes, just leave the default value of zero as the input.
(2) TEXT specifies the actual characters that are written on the screen. This can be any ASCII string, Upper/Lower case, and most symbols, up to 64 characters. If blanks are in the character string, the string must be enclosed in quotation marks.
(3) HEIGHT specifies the size (in pixels) of the annotation. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of TEXT and may need to be modified in combination.
(4) ASPECT is the aspect ratio of the TEXT characters. Larger values produce tall characters whereas smaller values produce wide characters. Note that characters that are too wide will overlap with each other and will render the text illegible. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of TEXT and may need to be modified in combination.
(5) ROTATION specifies the rotational angle of TEXT in degrees clockwise from the horizontal. For ROTATION=0 (default), TEXT will be horizontal and right-side up.
(6) ITALIC is the degree of italicization of text characters. The limits are -45 to +45 degrees, where positive values represent a clockwise direction.
(7) H_SPACE is the number of pixels by which to separate characters in TEXT. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of TEXT and may need to be modified in combination.
(8) V_SPACE is the number of pixels to leave blank above and below characters within their boxes. The effect of this parameter is only apparent when CHANNEL is not 0 and REV_VID="YES" or when CHANNEL=0 and BOXCOLR is not "TR".
(9) REV_VID. If "YES", the annotation will appear in "reverse video" such that the box surrounding the characters will be white whereas the characters will be transparent. This parameter is ignored if =0, i.e., if graphics planes are specified.
(10) CENTER specifies the placement of the annotation relative to the cursor center or input coordinates (X,Y). The three CENTER options are:

1 - plot characters so that the beginning of the text string is at the cursor/coordinates location. This is the default, which means that the cursor center/(X,Y) coordinates specify the position of the top-left corner of the first character of the text.

2 - plot characters so that the string is centered around the cursor/coordinates.

3 - plot characters so that the last character in the string is at the given cursor/coordinate location, i.e. the location specifies the end of the annotation line.

(11) CHRCOLR specifies the color of the annotation text when using the graphics planes. This parameter is ignored if the annotation is to be placed in a refresh memory channel (i.e. CHANNEL > 0). Each color is specified by a 2 character color-id. The colors are:

| | | |
|---|---|---|
| RE red | GR green | BL blue |
| YE yellow | CY cyan | OR orange |
| SA sand | BR brown | PI pink |
| GY gray | LG light green | MA magenta |
| TA tan | WH white | BK black |

(12) BOXCOLR specifies the color of the box surrounding the annotation text when using the graphics planes. Again, this parameter is ignored if CHANNEL>0. The default, "TR", selects a TRansparent box. Each color is specified by a 2 character color-id as defined in CHRCOLR.

(13) PLANES is used to select the two graphic planes on which the annotation is written. The colors of these graphic planes are assigned to the values of CHRCOLR and BOXCOLR respectively, when the proc is executed. If the planes selected already contain existing graphics, everything in them changes to the newly specified colors. There are 7 planes, numbered 1 through 7. The default planes are 1 and 2, i.e. plane 1, where the text is written, has the color value CHRCOLR, and the color BOXCOLR is assigned to plane 2 for the surrounding box.

(14) X is the pixel coordinate for the position of the annotation (see CENTER for more details on exactly where the text will be located relative to this point). The origin is located at the upper left of the screen for the IIS. This parameter is ignored for MODE=2, in which case the cursor is used to select the text location.

(15) Y is the line coordinate for the position of the annotation (see CENTER for more details on exactly where the text will be located relative to this point). The origin is located at the upper left of the screen for the IIS. This parameter is ignored for MODE=2, in which case the cursor is used to select the text location.

(16) MODE specifies which method is to be used in determining the position of the annotation (TEXT). MODE=1 specifies that the annotation is to be placed at the coordinates specified by the

X and Y parameters. MODE=2 specifies that the annotation is to be placed at the current cursor position.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Annotate | Enter New Parameters | Type Cursor X/Y Position | | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button causes the annotation to be written to the IIS screen.
B3: This button allows one to set new values for any of the input parameters.
C3: This button allows the user to display the cursor (x,y) coordinates on the terminal.
F3: This button exits the user from ANNOTATE.

**PROGRAM NAME:** ARABIA
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays illustrating interannual variabilities (1979-1982) for pigment and ancillary data fields in the northwest Arabian sea. These were created by John C. Brock, a PhD student at the University of Colorado, using SEAPAK.

The examples are, in sequence:

1. Early phase pigment concentration during Arabian sea southwest monsoon season (1979).
2. Late phase pigment concentration during Arabian sea southwest monsoon season (1979).
3. Early phase pigment concentration during Arabian sea southwest monsoon season (1980).
4. Late phase pigment concentration during Arabian sea southwest monsoon season (1980).
5. Early phase pigment concentration during Arabian sea southwest monsoon season (1981).
6. Late phase pigment concentration during Arabian sea southwest monsoon season (1981).
7. Early phase pigment concentration during Arabian sea southwest monsoon season (1982).
8. Late phase pigment concentration during Arabian sea southwest monsoon season (1982).
9. Florida State University (FSU) monthly mean total surface wind stress (July 1979-1982) - color bar.
10. July 1979 FSU surface wind stress.
11. July 1980 FSU surface wind stress.
12. July 1981 FSU surface wind stress.
13. July 1982 FSU surface wind stress.
14. Loop of examples 10-13.
15. FSU monthly mean total surface Ekman transport (July 1979-1982) - color bar.
16. July 1979 FSU Ekman transport.
17. July 1980 FSU Ekman transport.
18. July 1981 FSU Ekman transport.
19. July 1982 FSU Ekman transport.
20. Loop of examples 16-19.
21. FSU monthly mean total surface Ekman upwelling velocity (July 1979-1982) - color bar.
22. July 1979 FSU Ekman upwelling velocity.
23. July 1980 FSU Ekman upwelling velocity.
24. July 1981 FSU Ekman upwelling velocity.
25. July 1982 FSU Ekman upwelling velocity.
26. Loop of examples 22-25.
27. NOAA/Climate Analysis Center (CAC) monthly mean sea surface temperature (August 1979-1982) - color bar.

28. August 1979 CAC mean sea surface temperature.
29. August 1980 CAC mean sea surface temperature.
30. August 1981 CAC mean sea surface temperature.
31. August 1982 CAC mean sea surface temperature.
32. Loop of examples 22-25.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Buttons are defined in the programs called. To exit a loop, use F3.

**PROGRAM NAME:** ARRAY
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc was originally designed to perform arithmetic operations on the disk files generated from the Airborne Oceanographic Lidar (AOL) exchange tapes. It may, however, be used to perform arithmetic operations on any table with columns of numbers. The operations allowed are "+", "-", "*" (multiplication), "/" (division), LOG (common logarithm) and EXP (natural exponential). Any two parameters in the same file can be manipulated except with LOG and EXP which work on a single parameter only. Constants are allowed in all the operations. The input file would normally be generated from the proc TRAKIN or this proc (ARRAY), however, files created in the VAX editor or files downloaded from a PC can also be used if the format is correct. The format consists of a leading blank column followed by columns with an F10.3 specification. Each column must have a parameter name in the first row which is left justified in the 10 character field.

**PARAMETERS:**

(1) IN specifies the input ship track file name. This file should preferably originate from the proc TRAKIN or be a product of the current proc ARRAY. As was mentioned above, if the standard format for the ship track file (1X, F10.3, F10.3, F10.3....) is used, the file can be generated elsewhere. The extension ".LIS" will be used by default if it is omitted when specifying the file.

(2) P1 is the name of the first parameter on which to perform the arithmetic operation.

(3) C1 is the multiplier constant for the first parameter.

(4) P2 is the name of the second parameter to be used in the arithmetic operation. This parameter is ignored for LOG and EXP operations. One may enter a "-" to skip this parameter in order to accomplish a "+", "-", "*" or "/" operation on the constant C2 only.

(5) C2 is the multiplier constant for the second parameter. This constant is ignored for LOG and EXP operations.

(6) PARNEW is the name of the new output parameter.

(7) REPLACE specifies whether the old parameter is to be replaced or not. One must enter a "yes" to replace an existing parameter in the input ship track file. REPLACE is effective only if the PARNEW specified already exists in the input ship track file.

(8) OPER defines the intended operation:

"+" for summation, C1*P1 + C2*P2
"-" for subtraction, C1*P1 - C2*P2
"*" for multiplication, C1*P1 * C2*P2
"/" for division, C1*P1 / C2*P2

"LOG" for the common logarithm, LOG (C1*P1)
"EXP" for the natural exponential, EXP (C1*P1)

(9) OUT is the output file name. The extension ".LIS" will be used by default if it is omitted.

**IIS BUTTON DEFINITIONS:**
No buttons are employed by this proc.

**PROGRAM NAME:** ASC2GEM
**DATE:** 4/15/91
**MENU:** GEM4LIST

**DESCRIPTION:** This program is used for converting hydrographic program listing files to GEMPAK4 or Golden Software's Surfer format, in order that this data can be loaded into a GEMPAK binary file or Surfer spreadsheet and plotted as a cross section. Currently supported inputs include ASCII files created by the station data (RDNODCSD, RDNCSDBA), Skidaway (RDSKDWAY, RDSKDBA), XBT (RDXBT, RDXBTBA) and Southern Ocean Atlas (RDSOADS) listing programs within SEAPAK. Note that the inputs can be either a single file created by the batch version of these programs, or multiple files created from the interactive versions.

The output is an ASCII file in either GEMPAK4 sounding format (when TYPE=1,3), GEMPAK4 surface format (when TYPE=2) or Surfer spreadsheet format (when TYPE=4). The difference between TYPE=1 and TYPE=3 is that TYPE 1 output maintains the original times of each sounding, while TYPE 3 assigns the same time to all soundings, to facilitate plotting all of the soundings on the same horizontal map if desired. TYPE 1 is preferred if the user plans only to plot vertical profiles, and wants the flexibility of querying on time in addition to latitude/longitude. The sounding ASCII file can be used directly in conjunction with GEMPAK4 programs SNCFIL, SNEDIT and SNPROF to create, load and plot the GEMPAK4 sounding file. The sounding ASCII file can optionally contain a pressure column so that GEMPAK will be able to do vertical interpolations to levels not found in the original data set. The surface format is used to emulate the look of a vertical cross section for any parameter, since GEMPAK4's cross section program only draws isentropes (potential temperature lines) and related quantities. The user must run, in sequence, GEMPAK4 programs SFCFIL, SFEDIT, OAGRID, OABSFC and GDCNTR to create the GEMPAK surface file, load it with data, create a grid file, objectively analyze the random surface data into the grid file, and contour the gridded data. This final step effectively creates a vertical cross section, where latitude/longitude normally found in a GEMPAK4 grid file are replaced by depth/distance. Type 4 output contains columns for, respectively from left to right, distance along section, depth, each of the requested parameters, date and time. Although TYPE 4 output is designed primarily for sections of depth vs. distance, since it contains multiple profiles, the user could extract only specific lines corresponding to individual profiles in order to plot them in Golden Software Inc.'s Grapher package.

Also output with the GEMPAK4 format ASCII file is a station list which must accompany the data when creating either a GEMPAK sounding or surface file. For sounding output this is just a list of soundings, numbered sequentially with the corresponding latitude/longitude (each multiplied by 100 since GEMPAK will divide

by 100) of each site. For surface (i.e. cross section) output this is a list of each "station" (i.e. depth in this case) and the corresponding "latitude/longitude" (i.e. depth/ distance from origin). These station lists are needed so GEMPAK can navigate properly when plotting output. All station lists will have the name you specify in OUTFIL with "_stns" appended to the filetype.

Another file required by the GEMPAK4 programs SFCFIL and SNCFIL for creating surface and sounding files is found in CDF$DAT:HYDRO.PCK. This is a "parameter packing" file which defines all the possible hydrographic parameters, their minimum and maximum allowable values and number of places after the decimal to retain.

For Surfer output, up to two blanking/boundary files can be optionally created by ASC2GEM using parameter BLANK. The blanking file is used for creating a grid within the GRID module of Surfer, so that values (and ultimately, contours) are not generated below the bathymetry bottom depth. A boundary file is used for drawing the bottom contour for the TOPO module of Surfer, as either a crude (using only bottom depth values at the individual stations taken from the RD... program station list) or more detailed (using 5 minutes resolution NORDA bathymetry data along the entire section) representation.

**PARAMETERS:**

(1) INFIL are the names of up to 50 input files. These can be ASCII files created by any of the following programs:

RDNODCSD, RDNCSDBA (station data)
RDSKDWAY, RDSKDBA (Skidaway data)
RDXBT, RDXBTBA (XBT data)
RDSOADS (Southern Ocean Atlas data)

NOTE: Even though there is an upper limit of 50 files which can be specified (due to restriction imposed by TAE), there is no limit to the total number of profiles within these files which can be ingested.

(2) OUTFIL is the name of the converted file to be used in either GEMPAK4 or Surfer. A fully qualified VMS filename should be specified.

(3) TYPE is the type of conversion to be done. Type 1 (hydrographic data ASCII to GEMPAK4 sounding file ASCII, keeping original times) is used for ultimately plotting standard individual vertical profiles in GEMPAK4 (using SNCFIL, SNEDIT and SNPROF), and should only be selected when no plotting of the data at a horizontal level is expected. Type 2 (hydrographic data ASCII to GEMPAK4 surface file ASCII) is used for plotting a vertical cross section in GEMPAK4 (using SFCFIL, SFEDIT,OAGRID,OABSFC,GDCNTR in that order). Type 3 (hydrographic data ASCII to GEMPAK4 sounding file ASCII, using a single time) is similar to type 1, except a single time (the

time of the first sounding in INFIL) is assigned to all soundings, to facilitate plotting at a horizontal level. Type 3 output can also be used for plotting the individual soundings; however, the user cannot then select the sounding by time, only latitude/longitude. If this is not a problem, then type 3 is the preferred choice for sounding output since it is the most flexible. Type 4 (hydrographic data ASCII to PC Surfer spreadsheet format) creates a spreadsheet with columns for date, distance along section, and each of the parameters.

(4) PRMSEL is the parameter selection ID. If you choose "A", all parameters in INFIL, within certain limits, will be ingested. For TYPE=4 you can ingest all parameters as long as the output record does not exceed 160 bytes (roughly 14 parameters including depth). For GEMPAK, these limits are defined by current limitations of 9 sounding parameters or 7 surface parameters. If INFIL has more parameters than these limits, only the first (reading left to right in INFIL) 9 (sounding) or 7 (surface) will be ingested. Choosing "A" will enable you to run the program as a batch job since there will be no dynamic tutor for the parameters. If you choose "S", you will be prompted dynamically for which parameters you want to ingest from the full list present in INFIL. Therefore, do not choose "S" when running in batch mode.

(5) BLANK is the Surfer blanking/boundary file option. If an option other than null is entered for BLANK when TYPE=1,2 or 3, it is ignored. When TYPE=4 and a value of null is entered for BLANK, no blanking or boundary file will be created. For BLANK=1, a blanking file compatible with the GRID module of Surfer is created. This uses the filename portion of OUTFIL, appended by "_G". The filetype is .BLN, compatible with Surfer's default. This will effectively blank out grid points falling below the station's bottom depth so no data is plotted there. For BLANK=2, the blanking file for GRID is created AND a crude boundary file to be used within the TOPO module of Surfer for drawing bottom depths is created. The boundary file, created from bottom depths read from the RD... program data file from the VAX, uses the filename portion of OUTFIL, appended by "_T". The blanking file uses the filename portion of OUTFIL, appended by "_G". The filetypes are .BLN, compatible with Surfer's default. For BLANK=3, the blanking file for GRID is created AND a detailed boundary file to be used within the TOPO module of Surfer for drawing bottom depths is created. The boundary file contains full 5 minute (10 km) resolution NORDA bathymetry data at ALL points along the entire section. The blanking file uses the filename portion of OUTFIL, appended by "_G". The boundary file uses the filename portion of OUTFIL, appended by "_T". The file-type for both is .BLN, compatible with Surfer's default.

(6) TIME is the time to assign to data when TYPE=2 or TYPE=3, in the form: YYMMDD/HHMM (i.e. 860201/1200 for Feb. 1, 1986 at

1200 hours). Taking the default (null) results in the time of the first sounding in the group being used for all soundings.

(7) ID_STN1 is the ID number to use for station 1, and is used for TYPE=3 only. All of the output profiles in GEMPAK4 format are numbered sequentially. This parameter allows control over what the starting sequence number (i.e. for the first station in the list) will be. The value is 1 by default; however, the user may want to enter another number when they are creating individual files to ultimately be merged into a single sounding file. This will prevent overwriting of sounding files during the merge, since each sounding will have a unique station ID. This sounding file, containing soundings having the same time (i.e TYPE=3), can then be used to plot horizontal maps containing groups of soundings spanning more than one of the original ASC2GEM output ASCII files.

**DYNAMIC PARAMETERS:** Inputs for the following parameter will be requested if a value of "S" is entered for PRMSEL in the main tutor.

(1) PARMS are the abbreviations of the hydrographic data parameters to be converted. The abbreviations represent the following:

HGHT = height(depth)
TEMP = temperature
SALI = salinity
SIGT = sigma-T
SDSP = sound speed
O2 = oxygen
IPHS = inorganic phosphorus
TPHS = total phosphorus
PHOS = phosphate
SILI = silicate
SIO3 = silicate
NTRI = nitrite
NTRA = nitrate
PH = pH
RECD = record number

The value "HGHT" should always be included since it is needed in the output.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** ASCBLO
**DATE:** 4/15/91
**MENU:** ASCII

**DESCRIPTION:** This proc allows the user to generate an ASCII file, corresponding to blotch areas, of a SEAPAK image. The image is read from left to right and top to bottom within each blotched area with the values being placed in a single column for output. This proc can be run in an interactive mode (with the IIS display system) or in a non-interactive mode (without the IIS and possibly in a BATCH mode). If the subcommand "-DISPLAY" is used, the image must be currently displayed on the IIS along with any blotch area. The "-NODISPLAY" subcommand, however, allows several input image files to be entered, or several graphics planes from a blotch file, thus generating multiple output files. See below for more information on the subcommands "-DISPLAY" and "-NODISPLAY".

**SUBCOMMANDS:**

(1) -DISPLAY indicates that ASCBLO will generate an ASCII file of values from a displayed image corresponding to a blotch area or for the whole image. The image is read from left to right and top to bottom for the desired values. The output will consist of one column of these values. The image display unit must be allocated to you (using proc ALLOC) and, if the parameter GPLANE is not 0 (indicating the entire image), the desired blotch must reside on the specified graphics plane (see procs BLOTCH or BPSAV).

(2) -NODISPLAY indicates that ASCBLO will generate ASCII files of values from disk image files (INFILE). Multiple image files may be specified if only one value of the blotch parameter GPLANE is entered. In this case, the blotch area as specified by that GPLANE value will be used for each image file. Alternately, multiple GPLANE values may be entered if only one INFILE name is entered. In that case, the blotch area as specified by each GPLANE value will be applied to the one INFILE. If one value of GPLANE is not 0, indicating a blotch area, a disk blotch file (BLOFILE) must also be specified. The image display unit is not required for the "-NODISPLAY" subcommand.

**PARAMETERS:**

(1) INFILE (used only for "-NODISPLAY") is a list of the input images to be processed. More than one file may be entered if only one GPLANE value is entered. In such a case, the blotch as specified by GPLANE(1) will be applied to each INFILE. The output corresponding to each INFILE will be placed in the respective OUTFILE files. Therefore, the number of OUTFILE entries must be equal to that of INFILE entries. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) BLOFILE (used only for "-NODISPLAY") is the name of the blotch file which defines the image area(s) of interest and is used when not all GPLANE values are "0". Only blotches defined on the planes corresponding to GPLANE will be used. Recall that blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. If the GPLANE value(s) is "0", the full image will be processed and BLOFILE is ignored. The extension ".BLO" will be used by default if it is omitted from the file name.

(3) OUTFILE is the name(s) of the disk file containing the column of ASCII data which is extracted in the manner described above. If the subcommand is "-DISPLAY", this file is extracted from the currently displayed image and the single graphics plane defined by GPLANE which also must be displayed. If the subcommand is "-NODISPLAY", these files are extracted using the corresponding INFILEs, BLOFILE and GPLANEs. As mentioned earlier, more than one file may be entered only when one GPLANE value is entered, or vice versa. Thus the number of OUTFILEs specified must equal the number of INFILEs or GPLANEs, whichever is greater. The extension ".ASC" will be used by default if it is omitted from a file name.

(4) GPLANE defines the graphics plane(s) containing the blotch area(s) of interest. A number(s) in the range [-7,7] should be entered. For each entry, if the number is positive, the pixels used will be those inside the blotch corresponding to that graphics plane number; if negative, those outside the blotch will be used. The full image will be processed if "0" is entered. For "-DISPLAY", only one number can be entered. For "-NODISPLAY", up to 7 numbers can be entered if only one INFILE is specified. If more than one INFILE is entered, only one value for GPLANE can be entered. In the case where more than one GPLANE is entered, the blotch as specified by each GPLANE entry will be applied to that input file. The output corresponding to each GPLANE will be placed in the respective OUTFILE files. Therefore, the number of OUTFILE entries must be equal to that of GPLANE if more than one GPLANE is specified. Note that a different graphics plane value need not be entered in each GPLANE slot. For example, if GPLANE(1)=1 and GPLANE(2)=-1, the values for inside and outside the blotch of graphics plane 1 will be output to OUTFILE(1) and OUTFILE(2), respectively. If GPLANE(1)=1 and GPLANE(2)=1, identical output will be produced in OUTFILE(1) and OUTFILE(2).

(5) P_SUBS is the pixel subsampling rate. For example, if P_SUBS=2, only every other pixel encountered in the image area as specified by GPLANE will be used to generate a corresponding output value.

(6) L_SUBS is the line subsampling rate. For example, if L_SUBS=2, only every other line encountered in the image area as specified by GPLANE will be used to generate corresponding output values.

(7) MODE specifies whether the image data are linearly related to gray scales or are pigment concentrations. Enter "1" if the pixel values of the displayed image represent data such as temperature or radiances that are linearly related to gray levels (see FACTOR below); enter 2 if they represent pigment concentrations (mg/m3).

(8) FACTOR is a parameter which is used only when the input image(s) is linearly related to the gray scale, i.e. when MODE=1. If FACTOR is positive, it will represent the factor by which to divide the gray values of the image pixels in order to convert them into actual data values. If a zero or negative number is entered, the slope and intercept for this mapping function will be obtained from the file header of each image. To retain the gray scale values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(9) FORMAT specifies a FORTRAN format for the OUTFILE output. The format should have the general form of a field descriptor for the numeric output types I, F, E, D, or G. A field descriptor is composed of the letter type identifier (T), a width specification (W), and, for non-integer types, a decimal specification (D). In addition, the scale factor (P), the plus sign control (S), and the exponent specifier (E) may also be used. If omitted, the FORTRAN defaults of 0, SS, and 2, respectively, will be used. THE DEFAULT VALUE "1P,G13.5" SHOULD BE ADEQUATE FOR MOST PURPOSES. The following table presents examples of valid FORMAT values.

| FORMAT | T | W | D | P | S | E |
|---|---|---|---|---|---|---|
| 1P,G10.2 | G | 10 | 2 | 1 | SS | 2 |
| SP,I4 | I | 4 | | | SP | |
| F6.2 | F | 6 | 2 | | SS | |
| -2P,SP,E16.2E4 | D | 16 | 2 | -2 | SP | 4 |

Parentheses and commas may be omitted, but if they are used, they must be used according to FORTRAN format syntax rules. For example, the default FORMAT, "1P,G13.5", may also be written as "1PG13.5" or "(1P(G13.5))" but NOT as "1PG(13.5)" or "1PG,13.5". Blanks are ignored and lower or upper case letters may be used. For integer output (T='I'), the real-valued image pixels are rounded off to the nearest integer. The user should refer to the system's FORTRAN manual for additional definitions and syntax rules if there are any questions.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** ASCCNV
**DATE:** 4/15/91
**MENU:** GENUTIL

**DESCRIPTION:** This program allows the user to change the field delimiter in an ASCII file to another delimiter and create a new file in the process. The original file can then be deleted if one wishes.

**PARAMETERS:**

(1) IN_DEL is the field delimiter in the input file and is limited to one character in length. Some characters, such as a blank or tab, must be enclosed in double quotes when entering them as values. To enter a double quote as the delimiter, one must enter four double quotes (""""). Note that if a blank is entered, any string of blanks found in the input file will be treated as the delimiter to be replaced.

(2) OU_DEL is the field delimiter in the output file and is limited to one character in length. As for IN_DEL, some characters, such as a blank or tab, must be enclosed in double quotes when entering them as values. Again, to enter a double quote as the delimiter, enter four double quotes ("""").

(3) IN_FIL is the file containing the delimiter one wants to change. The extension ".ASC" will be used by default if it is omitted from a file name.

(4) OU_FIL is the name of the file which will contain the new delimiter. The extension ".ASC" will be used by default if it is omitted from a file name.

(5) DELETE is a flag for indicating whether or not to delete the input file. A "Y" should be entered to indicate that the input file should be deleted and an "N" to keep it.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** ASCCST
**DATE:** 4/15/91
**MENU:** GEOGRAPHIC

**DESCRIPTION:** This proc produces a file with latitude/longitude coordinates of world coastlines, using either the NORDA (5 minute resolution) or CIA data bases. The resolution of the data in the output can be controlled through the parameters "SPACING" (using NORDA) or "SSRATE" (using CIA). The greater degree of filtering (or the larger the subsampling rate) chosen, the coarser will be the resolution of the coastline produced. Note that for NORDA data, the filter applies to the global gridded bathymetry data set (before the coastline is found); for the CIA data set, the filter applies to the coastline itself. The output is an ASCII file, containing one or more coastline segments. For each segment, the total number of coordinates in that segment is given on the first line, and the coordinates (longitude followed by latitude) on the following lines. This format is compatible with the IBM PC/clone program "SURFER" and may be useful for other applications. If NORDA is chosen, the output is gridded and consecutive data points may not follow the coastline, whereas for CIA data it does. The exact region for generating the coastline can be defined through the parameters LAT and LON.

**PARAMETER:**
(1) SOURCE specifies the database to use for generating the coastline. If a "1" is entered, the CIA WDB-II is used. If "2" is entered, the NORDA bathymetry data set is utilized.

**DYNAMIC PARAMETERS:**
Depending on the choice of databases made with SOURCE, the user will be prompted with different parameters after RUN is typed. Both choices will result in input prompts for latitude/longitude ranges but the subsampling parameters are different.
(1) LAT specifies the latitude range for the coast. The southern most latitude followed by the northern most should be entered. The values entered should be in the range [-90,90].
(2) LON specifies the longitude range for the coast. The western most longitude followed by the eastern most should be entered. The values entered should be in the range [-180,180].
(3) INDEX (used only when SOURCE=1) specifies what level of detail the one would like to see of the CIA WDB-II. Since the CIA WDB-II coastline file provides global coverage of coasts, islands, lakes, etc., one must enter an index for each level of detail one wants to see:

```
WDB-II coastline index(es)
----------------------------
 1 major coast/islands/lakes
 2 additional major islands/lakes
 3 intermediate islands/lakes
```

4 minor islands/lakes
6 intermittent major lakes
7 intermittent minor lakes
8 reefs
9 major salt pans
10 minor salt pans
13 major ice shelves
14 minor ice shelves
15 glaciers

(4) SSRATE (used only when SOURCE=1) is the subsampling rate for the corresponding INDEX. An SSRATE value of n indicates that only every nth data base value will be used. For most applications, the maximum (default) value should be adequate and will greatly reduce the amount of time required for the proc to run.

(5) SPACING (used only when SOURCE=2) is the sampling frequency for latitude/longitude data. One should enter a "1" for no filtering, a "2" for plotting every second point, a "3" for plotting every third point, etc. Enter the latitude spacing followed by the longitude spacing.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** ASCENV
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program, which can be run interactively or in batch mode, allows the user to obtain ASCII listings of raw or diagnostic quantities of environmental data sets in the form of CDF's or binary bathymetry data. Output can be sent to the terminal (interactive mode only), or a file or printer (batch and interactive modes). The resulting ASCII files can then be read into environmental data plotting or imaging applications, such as GEMPLOT or ENVIMG.

**PARAMETERS:**

(1) DATE delineates the start and end data times to be extracted. Up to 25 DATE ranges can be specified. The format to be entered for start or end dates is YYMMDDHH for CDF's. This parameter is ignored for bathymetry data.

(2) LAT defines the latitude range for the data of interest (southern and northern limits, respectively), in the range -90.0 to 90.0.

(3) LON defines the longitude range for the data of interest (western and eastern limits, respectively), in the range -180.0 to 180.0.

(4) DATTYP is the data type to be extracted. The following is a list of the acceptable entries:

| | | |
|---|---|---|
| CDF | - | Common Data Format from NSSDC; must use the parameters CDFNAM, CDFPRM, LEVTYP and possibly LEVEL when using a CDF dataset. |
| BATHY | - | NORDA bathymetry (m); maximum of 240x135 array can be ingested |

(5) MEANPLT is a flag indicating whether or not to average the data selected over the time frame given by DATE before outputting it to the disk file(s) given by FILENAME. A "0" should be entered to output the data for all the times given in the time frame DATE (to multiple versions of FILENAME when more than one set of data lies in the given time frame). A "1" should be entered if only the mean is desired.

(6) SPACING is the sampling frequency for latitude/longitude data. One should enter a "1" for no filtering, a "2" for plotting every second point, a "3" for plotting every third point, etc. Enter the latitude spacing followed by the longitude spacing.

(7) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an

up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(8) CDFPRM is the mnemonic(s) of the CDF variable. Run CDFLST to obtain a list of contents of a particular CDF. When a raw quantity is desired, specify this in CDFPRM(1). When a diagnostic quantity is desired, specify the diagnostic mnemonic in CDFPRM(1), u wind mnemonic in CDFPRM(2), v wind mnemonic in CDFPRM(3), and height field mnemonic (if needed for geostrophic computations) in CDFPRM(4). Possible values for CDFPRM(1) include:

| | | |
|---|---|---|
| DIV | = | divergence (1/sec) of raw wind |
| CURL | = | vertical component of curl, vorticity (1/sec) of raw wind |
| DIVG | = | divergence (1/sec) of geostrophic wind |
| CURLG | = | vertical component of curl, vorticity (1/sec) of geos. wind |
| TAU | = | total surface stress (N/m**2) |
| TAUX | = | E-W surface stress (N/m**2) |
| TAUY | = | N-S surface stress (N/m**2) |
| TAUG | = | total surface stress (N/m**2) based on geostrophic winds |
| TAUGX | = | E-W surface stress (N/m**2) based on geostrophic winds |
| TAUGY | = | N-S surface stress (N/m**2) based on geostrophic winds |
| TAU3 | = | total surface stress to the 1.5 power (N**1.5/m**3) |
| TAUG3 | = | total surface stress ** 1.5 (N**1.5/m**3) - based on geostrophic winds |
| EKM | = | total surface Ekman transport (m**2/s) |
| EKMX | = | E-W surface Ekman transport (m**2/s) |
| EKMY | = | N-S surface Ekman transport (m**2/s) |
| EKMG | = | total surface Ekman transport (m**2/s) - based on geostrophic winds |
| EKMGX | = | E-W surface Ekman transport (m**2/s) - based on geostrophic. winds |
| EKMGY | = | N-S surface Ekman transport (m**2/s) - based on geostrophic winds |
| UPWEL | = | Ekman upwelling - based on raw winds (m/s) |
| UPWELG | = | Ekman upwelling - based on geostrophic winds (m/s) |
| WIND | = | raw wind speed contours (m/s) |
| WINDG | = | geostrophic wind speed contours (m/s) |
| WDDIR | = | raw wind direction, 0 to 360 degrees |

A value for this parameter must be entered if DATTYP=CDF.

(9) LEVEL is the CDF level value of type LEVTYP and must be entered if a LEVTYP other than "NONE" is indicated. The units correspond to the LEVTYP, and will typically be in meters (for depth or height) or millibars (for atmospheric pressure)

(10) LEVTYP is the CDF level type mnemonic and must be specified if applicable. One should enter "NONE" when there is no level

information in the CDF (i.e. only data at one level). When multi-level data is present in the dataset, specifying LEVTYP="NONE" will extract only the first level (i.e. whatever level is in the first element of the level array).

(11) DEST designates whether the output should go to the terminal (enter a "T"), the printer (enter a "P") or to a disk file (enter an "F"). If this program is being run in a batch mode, a "T" cannot be entered.

(12) FILENAME is the output disk file name. Note that multiple versions are created if DATE and MEANPLT call for multiple times. The default is ".LIS" when not specified.

(13) LANDMASK is a flag indicating whether to mask the land in the data extracted. If a "Y" is entered, no values will be extracted over land areas. The determination of land/water is based on data from the NORDA digital bathymetry database. If an "N" is entered, the output will be produced even over land, if the original dataset has values over land.

(14) SONY is a flag indicating whether to mount one or both SONY WORM drives for use in running ASCENV. If the default "--" (null) is entered, the program will not use the SONY. If "0" is entered, drive DIATOM::LDB0 will be mounted (DIATOM is a node of the Laboratory for Hydrospheric Processes' local area Vax cluster). If "1" is entered, drive DIATOM::LDB1 will be mounted. If "2" is entered, both drives DIATOM::LDB0 and DIATOM::LDB1 will be mounted. Any SONY drive mounted will be dismounted automatically when the program terminates.

(15) TYPE is the component type for stress-related fields. If a value of "1" is entered, the second and third values for parameter CDFPRM are assumed to be zonal and meridional components of stress, which are present in the requested CDF. Other quantities such as Ekman upwelling and transport could then be derived directly from the stress components. If a value of "2" is entered, the second and third values for CDFPRM are assumed to be raw surface wind components. In this case, no cyclonic rotation or decrease in magnitude will be applied to the resultant stress vector. If a value of "3" is entered, the second and third values for CDFPRM are assumed to be raw 1000 millibar wind components. In this case, the resultant stress vector will be rotated cyclonically by 15 degrees and decreased in magnitude by 30% to extrapolate it to a surface value.

(16) METHOD is the drag coefficient computation method to be used for stress computations. METHOD=1 uses the following formulation taken from Large and Pond (1981),

```
Drag = 1.14 x 10**-3, |U at 10 m| < 10 m/s
Drag = 10**-3*(0.49 + 0.065 x |U at 10 m|),
                    |U at 10 m| > 10 m/s
```

METHOD=2 uses linear drag coefficient segments, where the wind magnitude break points are specified in CDBREAK and drag

coefficients for ranges between the breaks are specified in DRAG.

(17) CDBREAK are the wind magnitude break points for drag coefficients, to be used for stress computations. If the null value is kept, a constant drag coefficient (specified in DRAG(1)) is used. Otherwise, either one or two values are input for CDBREAK, and two or three values respectively should be entered for DRAG. The values for CDBREAK should be greater than 0 (0 is automatically defined as a break point). The values for DRAG will be applied inclusive of each break point in CDBREAK.

(18) DRAG are the drag coefficient values, to be used for stress computations, when METHOD=2 is specified. Each drag coefficient in sequence will be applied to stress computations for wind magnitudes within the corresponding range defined by the entries of CDBREAK. If the null value is kept for CDBREAK, the value of DRAG(1) is used as the constant drag coefficient.

(19) INCREM is the time increment between lists, in the format YYMMDDHH for CDF's, and ignored for bathymetry. Times will be chosen with values INCREM apart between the start and end dates specified in DATE.

**IIS BUTTON DEFINITIONS:**

No buttons are required in this program.

**PROGRAM NAME:** ASCFUNC
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program can perform addition, subtraction, averaging, find the maximum and minimum data value, or create a Common Data Format (CDF) for a group of up to 50 co-located, gridded, ASCII environmental data files (for subtraction, only the first two files are used). These files can be created from any of the environmental imaging, mapping or time series programs. The program can be run in batch mode, in which case the output is sent to the file ASCFUNC.LOG in the user's current directory.

**PARAMETERS:**

(1) FUNC is the function to perform on the ASCII files:

Specify:
1 for addition of all files specified in ASCFIL
2 for subtraction of ASCFIL(1) from ASCFIL(2)
3 for averaging all files specified in ASCFIL
4 for finding the maximum and minimum over all files specified in ASCFIL
5 to create a Common Data Format(CDF) set of files from the input files.

The output file with name OUTFIL will be created for FUNC=1, 2 or 3. For FUNC=4, the range will be written to the terminal.

(2) ASCFLG is the input ASCII file type flag: specify 0 to indicate that all files in ASCFIL are gridded data files or 1 to indicate that the files are time series data files. Time series files are created by program TIMENV, and gridded files can be created by the programs ENVIMG, ASCENV, GEMPLOT or CDFLST. For FUNC=5 (CDF creation), ASCFLG must be 0 (gridded data input) for the program to run.

(3) EXCLUDE are up to two data values to be excluded when computing the data maximum and minimum for the ASCFIL names(used for FUNC=4 only). This might be useful, for instance, if you are computing the range of ASCII files which contain grids of gray levels from an outside source, and one of the gray levels is used for land masking (i.e. GFDL model data run through program CNVGRD is one example).

(4) OUTFIL is the name of the output environmental data ASCII file (for FUNC=1,2, or 3) or CDF files (do not include file extension; used for FUNC=5 only).

(5) ASCFIL are the names of up to 50 environmental data ASCII files, all of the same type (either time series format or gridded data format). If not specified, default directory for a file is the user's root, and for filetype is ".ASC."

(6) TIMES are the times to associate with ASCFIL names in the output CDF, when FUNC=5 only. Times are of the form YYMMDDHH (year, month, day, hour). For example, 85010100 is inter-

preted as 00 hrs. on Jan. 1, 1985. The list of times must be chronological in sequence. All the times must be known at the outset since this defines the record structure in the CDF, and during the program run each grid defined by ASCFIL will be written in sequence to the CDF.

(7) P1 are the parameter names corresponding to ASCFIL(s), used for FUNC=5 only. The mnemonics specified will be written into the CDF for each data grid named in ASCFIL. P2 only need be provided if ASCFIL contains a vector. For vector fields, this represents the zonal component (which appears first in the ASCII file).

(8) P2 are the parameter names corresponding to ASCFIL(s), used for FUNC=5 only and vector inputs. The mnemonics specified will be used to write the second component for each data grid named in ASCFIL. It only needs to be provided if ASCFIL contains a vector field, in which case this represents the meridional component (which appears second in the ASCII file).

(9) UNITS1 are the units for parameters in P1, used for FUNC=5 only. Specify one input for each input of P1.

(10) UNITS2 are the units for parameters in P2, used for FUNC=5 only. Specify one input for each input of P2.

(11) DESC1 are the descriptions for parameters in P1, used for FUNC=5 only. Specify one input for each input of P1.

(12) DESC2 are the descriptions for parameters in P2, used for FUNC=5 only. Specify one input for each input of P2.

(13) CTITLE is the descriptive title to be written to the CDF, used for FUNC=5 only.

**IIS BUTTON DEFINITIONS:**

No buttons are required in this program.

**PROGRAM NAME:** ASCIMG
**DATE:** 4/15/91
**MENU:** ASCII

**DESCRIPTION:** ASCIMG is a proc which can be used to generate an ASCII file of an image. Up to five SEAPAK images or any rectangular subscene from them can be converted at one time to ASCII flat-file equivalents. This proc not only allows one to select a portion of the scene for conversion to ASCII files but also allows one to subsample the scene or flip it around from left to right or top to bottom. Also, the format of the ASCII output file records may be specified by the user.

**PARAMETERS:**

(1) IN_FILES contains the list of input image files one wants to convert to ASCII files. Enter the names of up to five SEAPAK image files. These files when converted will correspond to the output image files (OU_FILES) and will all have been processed in the same manner.

(2) OU_FILES contains the ASCII equivalents of the respective SEAPAK image files listed in IN_FILES. Note that all these files will be generated using the same values for all the other input parameters. These files will also not contain any header records. The format is specified by the user. See the parameter FORMAT for a detailed description of their record formats. The default extension on the file name is ".ASC".

(3) ST_PIX defines the location of the start pixel for the rectangular area of the image(s) for which ASCII file(s) will be generated. ST_PIX/ST_LIN and END_PX/END_LN define the full rectangle. The value one inputs for ST_PIX depends on the location of the origin which in turn is determined by the parameter P_DIR and TOT_PX. In other words, if P_DIR=1, pixel positions are enumerated from left to right and ST_PIX is the pixel position of a left corner. If P_DIR=2, pixel positions are enumerated from right to left, and ST_PIX is the pixel position of the right corner of the rectangle. This means that the number entered for ST_PIX is determined by counting pixels from the right starting at the origin (which is defined by TOT_PX), e.g. the right most pixel (the origin) is 1, the next is 2, etc. Note that all this also means that ST_PIX can never be greater than END_PIX.

(4) ST_LIN is the location of the start line for the rectangular area of the image(s) for which ASCII file(s) will be generated. As mentioned earlier, ST_PIX/ST_LIN and END_PX/END_LN define the full rectangle. As for ST_PIX, the value one inputs for ST_LIN depends on the location of the origin which in turn is determined by the parameter L_DIR and TOT_LN. In other words, if L_DIR=1, line positions are enumerated from top to bottom; ST_LIN is the line position of a top corner. If L_DIR=2, line positions are enumerated from bottom to top and ST_LIN is the line position of a bottom corner of the

rectangular box. In a similar fashion to ST_PIX, the number entered for ST_LIN is determined by counting lines from the bottom starting at the origin (which is defined by TOT_LN), e.g. the bottom most line (the origin) is 1, the next is 2, etc. It is evident that this means that ST_LIN cannot be greater than TOT_LN. From all of this it is also clear that ST_LIN cannot be greater than END_LIN.

(5) END_PX is the location of the end pixel and helps to define one corner of the rectangular area of the image(s) for which ASCII file(s) will be generated. END_PX cannot be less than ST_PIX since as previously mentioned the origin for counting the pixels starts from the ST_PIX direction. In other words, if P_DIR=1, pixel positions are enumerated from left to right and END_PX is the pixel position of a right corner. If P_DIR=2, pixel positions are enumerated from right to left and END_PX is the pixel position of a left corner. END_PX cannot be greater than TOT_PX.

(6) END_LN is the location of the end line and helps to define one corner of the rectangular area of the image(s) for which ASCII file(s) will be generated. Again due to the location of the origin, END_LN cannot be less than ST_LIN. Also, if L_DIR=1, line positions are enumerated from top to bottom and END_LN is the line position of a bottom corner. If L_DIR=2, line positions are enumerated from bottom to top and END_LN is the line position of a top corner. END_LN cannot be greater than TOT_LN.

(7) P_SUBS is the parameter which specifies the pixel subsampling rate. For example, if P_SUBS=2, only every other pixel from ST_PIX to END_PX will be processed and the resulting ASCII image (OU_FILES) will be reduced by a factor of two in the pixel (horizontal) direction. Note that the last pixel processed for each line will be

    ST_PIX + (N-1)*P_SUBS

where N is the number of pixels processed per line or

    Integer((END_PX-ST_PIX + P_SUBS)/P_SUBS).

(8) L_SUBS defines the line subsampling rate. For example, if L_SUBS=2, only every other line from ST_LIN to END_LN will be processed and the resulting OU_FILES will represent images reduced by a factor of two in the line (vertical) direction. Note that the last line processed for each file will be

    ST_LIN + (N-1)*L_SUBS

where N is the number of lines processed per image or

    Integer ((END_LN-ST_LIN + L_SUBS)/L_SUBS).

(9) MODE specifies whether the image data (IN_FILES) are linearly related to gray scales or are pigment concentrations. Enter 1 if the pixel values of the displayed image represent data such as temperature or radiances that are linearly related to gray levels (see FACTOR below); enter 2 (the default value) if they represent pigment concentrations (mg/m3).

(10) FACTOR is a parameter which is used only when the displayed image is linearly related to the gray scale, i.e. when MODE=1. If FACTOR is positive, it will represent the factor by which

to divide the gray values of the image pixels in order to convert them into actual data values. If a zero or negative number is entered, the slope and intercept for this mapping function will be obtained from the file header of each IN_FILES. To retain the gray scale values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(11) FORMAT specifies a FORTRAN format for the records of OU_FILES. Generally, the default format should be used. The format should have the general form of a repeat count (N) followed by a field descriptor for the numeric output types I, F, E, D, or G. A field descriptor is composed of the letter type identifier (T), a width specification (W), and, for non-integer types, a decimal specification (D). If N is not specified, it defaults to 1; if it is explicitly 0, it is set to the number of pixels processed per image line (X); if it is less than X, each image line will wrap around using as many output records as needed (see below). In addition, the scale factor (P), the plus sign control (S), and the exponent specifier (E) may also be used; if omitted, the FORTRAN defaults of 0, SS, and 2, respectively, will be used. AGAIN IT SHOULD BE EMPHASIZED THAT THE DEFAULT VALUE "1P,0(G10.2)" SHOULD BE ADEQUATE FOR MOST PURPOSES. The following table presents examples of valid FORMAT values.

| FORMAT | N | T | W | D | P | S | E |
|---|---|---|---|---|---|---|---|
| 1P,0(G10.2) | X | G | 10 | 2 | 1 | SS | 2 |
| SP,I4 | 1 | I | 4 | | | SP | |
| 18(F6.2) | 18 | F | 5 | 2 | | SS | |
| -2P,SP,10(E16.2E4) | 10 | D | 16 | 2 | -2 | SP | 4 |

Parentheses and commas may be omitted, but if they are used, they must be used according to FORTRAN format syntax rules. For example, the default FORMAT, "1P,0(G13.5)", may also be written as "1P0G13.5" or "(1P0(G13.5))" but NOT as "1P0G (13.5)" or "1P0,G13.5". Slash record terminators ("/") may also be included according to FORTRAN rules. Blanks are ignored and lower or upper case letters may be used. For integer output (T='I'), the real-valued image pixels are rounded off to the nearest integer. (Please refer to the system's FORTRAN manual for additional definitions and syntax rules.)

The number of output records needed for one image line will be

NR = integer((X + N - 1) / N)

where N and X are as defined above. (Note that additional records due to the use of slash record terminators in FORMAT are not included in any record calculations.) The last record of each NR set of records will contain X - (NR-1)*N pixel values. The character width of every output record will be N

* W plus, if a delimiter is added, N, (e.g. for DELIM="/", the character width of each output record will be W*N + N). Records which do not contain N values will be filled with trailing blanks.

(12) DELIM may be used to insert a one-character delimiter after each pixel data value field in the ASCII output files. Certain spreadsheet or statistical programs, which one may wish to use on the output files, require such delimiters. Some characters, such as a blank or tab, must be enclosed within double quotes when entering them as values to DELIM. To enter a double quote as a delimiter, four double quotes must be entered (""""). The null value, "--" (the default value) may be entered to indicate that no delimiters are to be used. Note that, in any case, blanks may be present between pixel values when the field width specified by FORMAT is large enough.

(13) HEADER is the number of header records in each of the input images (IN_FILES). It is assumed that each input image has the same number of header records. SEAPAK image files normally have one header record (the default value). These records must not be counted in any image line specification (ST_LIN, END_LN, and TOT_LN). The ASCII output files, OU_FILES, may or may not contain any header records depending on the value of TYPE.

(14) FLIP defines the ASCII output file orientation. Enter one of the following values to designate the orientation of the images represented in OU_FILES relative to those in IN_FILES:

0: same (the default value);
1: reversed in the horizontal direction (mirror image);
2: reversed in the vertical direction (upside down);
3: reversed in the horizontal and vertical directions (mirror and upside down)

(15) TYPE indicates whether the ASCII output file(s), OU_FILES, should be modified for an IBM-PC based program called SURFER. If the regular ASCII output with no header blocks is desired, one should enter a zero. On the other hand if one intends to use these files with SURFER, one should enter a value of 1. This causes the proc to generate a special 5 line header required by SURFER which precedes the pixel data.

(16) P_DIR indicates whether one is counting pixel positions from left to right (enter 1 if so) or from right to left (in which case, enter a 2). Recall that if P_DIR = 1, the left most pixel is 1; if P_DIR = 2, the right most pixel (as defined by TOT_PX) is 1. See ST_PIX, END_PX, and TOT_PX for more information.

(17) L_DIR indicates whether one is counting line positions from left to right (enter 1 if so) or from right to left (in which case, enter a 2). Recall that if L_DIR = 1, the top most line is 1; if L_DIR = 2, the bottom most line (as defined by

TOT_LN) is 1. See ST_LIN, END_LN, and TOT_LN for more information.

(18) TOT_PX is used only if P_DIR=2. The value for this parameter will generally correspond to the width in pixels of the display system or to the right-most pixel of the ASCII image one is interested in producing. TOT_PX essentially enables SEAPAK to determine the right-most pixel of an image. For example, if TOT_PX=512, then the 512th pixel of each image line will be considered position 1 for the purpose of specifying ST_PIX and END_PX.

(19) TOT_LN is used only when L_DIR=2. The value for this parameter will generally correspond to the length in lines of the display system or to the bottom-most line of the ASCII image one is interested in producing. TOT_LN essentially enables SEAPAK to determine the bottom-most line of an image. For example, if TOT_LN=512, then the 512th line of each image will be considered as position 1 for the purpose of specifying ST_LIN and END_LN.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** ASCOUT
**DATE:** 4/15/91
**MENU:** ASCII

**DESCRIPTION:** ASCOUT is a proc which can be used to generate an ASCII file of an image. Up to five SEAPAK images or any rectangular subscene from them can be converted at one time to ASCII flat-file equivalents. This proc not only allows one to select a portion of the scene for conversion to ASCII files, but also allows one to subsample the scene or flip it around from left to right or top to bottom. In addition, the format of the ASCII output file records may be specified by the user. The difference between ASCOUT and ASCIMG is only in the input parameters; both procs can provide the same ASCII output image. ASCOUT requires that you always count pixels from left to right and lines from top to bottom; whereas ASCIMG allows you to chose whatever is more convenient. The end result is the same, however.

**PARAMETERS:**

(1) IN_FILES contains the list of input image files one wants to convert to ASCII files. Enter the names of up to five SEAPAK image files. These files when converted will correspond to the output image files (OU_FILES) and will all have been processed in the same manner. The extension ".IMG" will be used by default if it is omitted from a file name.

(2) OU_FILES contains the ASCII equivalents of the respective SEAPAK image files listed in IN_FILES. Note that all these files will be generated using the same values for all the other input parameters. These files will not contain any header records unless specifically requested by using the parameter TYPE. The format of OU_FILES is specified by the user. See the parameter FORMAT for a detailed description of their record formats and DELIM for a discussion on the delimiters between pixel values. The default extension on the file name is ".ASC".

(3) ST_PIX defines the location of the start pixel for the rectangular area of the image(s) for which ASCII file(s) will be generated. ST_PIX/ST_LIN and END_PX/END_LN define the full rectangle. Pixel positions are enumerated from left to right (with left most pixel being 1) and ST_PIX is the pixel position of a left corner of the rectangular area.

(4) ST_LIN is the location of the start line for the rectangular area of the image(s) for which ASCII file(s) will be generated. As mentioned earlier, ST_PIX/ST_LIN and END_PX/END_LN define the full rectangle. Line positions are enumerated from top to bottom (the top most line being 1) with ST_LIN being the line position of a top corner.

(5) END_PX is the location of the end pixel and helps to define one corner of the rectangular area of the image(s) for which ASCII file(s) will be generated.

(6) END_LN is the location of the end line and helps to define one corner of the rectangular area of the image(s) for which ASCII file(s) will be generated.

(7) P_SUBS is the parameter which specifies the pixel subsampling rate. For example, if P_SUBS=2, only every other pixel from ST_PIX to END_PX will be processed and the resulting ASCII image (OU_FILES) will be reduced by a factor of two in the pixel (horizontal) direction. Note that the last pixel processed for each line will be

ST_PIX + (N-1)*P_SUBS

where N is the number of pixels processed per line or

Integer((END_PX-ST_PIX + P_SUBS)/P_SUBS).

(8) L_SUBS defines the line subsampling rate. For example, if L_SUBS=2, only every other line from ST_LIN to END_LN will be processed and the resulting OU_FILES will represent images reduced by a factor of two in the line (vertical) direction. Note that the last line processed for each file will be

ST_LIN + (N-1)*L_SUBS

where N is the number of lines processed per image or

Integer ((END_LN-ST_LIN + L_SUBS)/L_SUBS).

(9) MODE specifies whether the image data (IN_FILES) are linearly related to gray scales or are pigment concentrations. Enter 1 (the default value) if the pixel values of the displayed image represent data such as temperature or radiances that are linearly related to gray levels (see FACTOR below); enter 2 if they represent pigment concentrations (mg/m3).

(10) FACTOR is a parameter which is used only when the displayed image is linearly related to the gray scale, i.e. when MODE=1. If FACTOR is positive, it will represent the factor by which to divide the gray values of the image pixels in order to convert them into actual data values. If a zero or negative number is entered, the slope and intercept for this mapping function will be obtained from the file header of each IN_FILES. To retain the gray scale values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(11) FORMAT specifies a FORTRAN format for the records of OU_FILES. Generally, the default format should be used. The format should have the general form of a repeat count (N) followed by a field descriptor for the numeric output types I, F, E, D, or G. A field descriptor is composed of the letter type identifier (T), a width specification (W), and, for noninteger types, a decimal specification (D). If N is not specified, it defaults to 1; if it is explicitly 0, it is set to the number of pixels processed per image line (X); if it is less than X, each image line will wrap around using as many output records as needed (see below). In addition, the scale factor (P), the plus sign control (S), and the exponent specifier (E) may also be used; if omitted, the FORTRAN defaults of 0, SS, and 2, respectively, will be used. AGAIN IT SHOULD BE EMPHASIZED THAT THE DEFAULT VALUE "1P,0(G13.5)" SHOULD BE ADEQUATE FOR

MOST PURPOSES. The following table presents examples of valid FORMAT values.

| FORMAT | N | T | W | D | P | S | E |
|---|---|---|---|---|---|---|---|
| 1P,0(G13.5) | X | G | 13 | 5 | 1 | SS | 2 |
| SP,I4 | 1 | I | 4 | | | SP | |
| 18(F6.2) | 18 | F | 5 | 2 | | SS | |
| -2P,SP,10(E16.2E4) | 10 | D | 16 | 2 | -2 | SP | 4 |

Parentheses and commas may be omitted, but if they are used, they must be used according to FORTRAN format syntax rules. For example, the default FORMAT, "1P,0(G13.5)", may also be written as "1P0G13.5" or "(1P0(G13.5))" but NOT as "1P0G (13.5)" or "1P0,G13.5". Slash record terminators ("/") may also be included according to FORTRAN rules. Blanks are ignored and lower or upper case letters may be used. For integer output (T='I'), the real-valued image pixels are rounded off to the nearest integer. (Please refer to the system's FORTRAN manual for additional definitions and syntax rules.)

The number of output records needed for one image line will be

NR = integer((X + N - 1) / N)

where N and X are as defined above. (Note that additional records due to the use of slash record terminators in FORMAT are not included in any record calculations.) The last record of each NR set of records will contain X - (NR-1)*N pixel values. The character width of every output record will be N * W plus, if a delimiter is added, N, (e.g. for DELIM="/", the character width of each output record will be N*W + N.) Records which do not contain N values will be filled with trailing blanks.

(12) DELIM may be used to insert a one-character delimiter after each pixel data value field in the ASCII output files. Certain spreadsheet or statistical programs, which one may wish to use on the output files, require such delimiters. Some characters, such as a blank or tab, must be enclosed within double quotes when entering them as values to DELIM. To enter a double quote as a delimiter, four double quotes must be entered (""""). The null value "--" (the default value) may be entered to indicate that no delimiters are to be used. Note that, in any case, blanks may be present between pixel values when the field width specified by FORMAT is large enough.

(13) HEADER is the number of header records in each of the input images (IN_FILES). It is assumed that each input image has the same number of header records. SEAPAK image files normally have one header record (the default value). These records must not be counted in any image line specification (ST_LIN, END_LN, and TOT_LN). The ASCII output files, OU_FILES, will

or will not contain header records depending on the value for TYPE.

(14) FLIP defines the ASCII output file orientation. Enter one of the following values to designate the orientation of the images represented in OU_FILES relative to those in IN_FILES:

- 0: same (the default value);
- 1: reversed in the horizontal direction (mirror image);
- 2: reversed in the vertical direction (upside down);
- 3: reversed in the horizontal and vertical directions (mirror and upside down)

(15) TYPE indicates whether the ASCII output file(s), OU_FILES, should be modified for an IBM-PC based program called SURFER. If the regular ASCII output with no header blocks is desired, one should enter a zero. On the other hand if one intends to use these files with SURFER, one should enter a value of 1. This causes the proc to generate a special 5 line header required by SURFER which precedes the pixel data.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** ASCRANGE
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program determines the maximum and minimum data values for a group of up to 50 environmental data ASCII files which were created using ASCENV. The purpose of the program is to provide the limits required by programs which utilize these ASCII files to create contours (GEMPLOT), images (ENVIMG) and time series plots (TIMENV). Specified data values can be excluded from the computation of maximum/minimum using parameter EXCLUDE. The program can be run in batch mode, in which case the output is sent to the user's current directory with the name ASCRANGE.LOG.

NOTE: A new program, ASCFUNC, has been added to version 2 to provide all of the functions of ASCRANGE, plus the capabilities to add or subtract environmental ASCII files, compute a mean ASCII file, or create a Common Data Format (CDF) file group from up to 50 ASCII files. ASCRANGE will no longer be supported.

**PARAMETERS:**
(1) ASCFIL is an array of up to 50 input file names which can be input in any order.
(2) EXCLUDE is an array of up to 2 data values to be excluded when computing the data limits.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** ASCTRANS
**DATE:** 4/15/91
**MENU:** GRIDANL

**DESCRIPTION:** This program allows you to specify a single variable, a single time and a transect line in latitude/longitude space (i.e. the X/Y plane) to generate a depth (height) vs. distance ASCII output file using three-dimensional data in the National Space Science Data Center (NSSDC) Common Data Format (CDF). The output file can be used to plot individual profiles along the transect using Golden Software Inc.'s Grapher program for the PC, a cross section using Golden Software Inc.'s Surfer program for the PC, or either profiles or cross sections in other spreadsheet-oriented commerical graphics packages. The program assumes that the user knows the CDF name and already has run SEAPAK program CDFLST in order to obtain the variable's mnemonic (PARM), the date/time (DATE), the level mnemonic (LEVTYP) and the starting level value (LEVEL). Starting and ending positions determine the location of the transect line. Data will be extracted based on LEVEL and number of levels (NLEVEL). The user can specify the number of segments along the transect line. A bi-linear interpolation scheme is used to derive data which falls between CDF grid points.

**PARAMETERS:**

(1) SONY is the optical disk flag. A null input indicates that the Sony drive need not be mounted during the program run, and that the CDF files are on magnetic disk. An input of "0" means that drive DIATOM::LDB0: should be mounted because an optical platter containing the requested CDF files will be read in that drive. An input of "1" means that drive DIATOM::LDB1: should be mounted because a platter containing the requested CDF files will be read in that drive.

(2) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(3) PARM is the mnemonic of the CDF variable to be processed. The SEAPAK program CDFLST should be run to obtain a list of the complete set of mnemonics for the requested CDF.

(4) DATE is the time for the data to be extracted from the CDF. Specify DATE(1) in the form YYMMDDHH (year/month/day) and DATE(2) in the form MMSSMSS (minutes/seconds/milliseconds).

(5) LEVTYP is the mnemonic of the CDF level (vertical coordinate) parameter. The SEAPAK program CDFLST should be run to obtain the name of this mnemonic for the requested CDF. The mnemonic is typically either "HEIGHT", "DEPTH" or "PRESSURE". Specify a value of "NONE" for single-level or surface data-only

datasets (i.e. datasets without level information), or to extract only the first level stored in a multi-level dataset (i.e. whatever level is in the first element of the level array).

(6) DTYPE is the data (i.e. LEVEL type). Specify a value of "1" if the data is meteorological (all levels will be made positive so the section has the lowest heights at the bottom) or "-1" if the data is oceanographic (all levels will be made negative so the section has greatest depths at the bottom).

(7) LEVEL is the starting level value of parameter LEVTYP. The user should run CDFLST to obtain a list of the levels present in the requested CDF.

(8) NLEVEL is the number of levels to extract from the CDF data, beginning at the point in the CDF level array specified by LEVEL and continuing for NLEVEL-1 additional elements in the array. Specify NLEVEL=-1 to obtain all available levels from the multi-level CDF (the value of LEVEL is ignored in this case).

(9) START is the starting latitude and longitude, respectively, of the transect line, in degrees. The range for latitude is -90 (south) to 90 (north). The range for longitude is -180 (west) to 180 (east).

(10) END is the ending latitude and longitude, respectively, of the transect line, in degrees. The range for latitude is -90 (south) to 90 (north). The range for longitude is -180 (west) to 180 (east).

(11) SEGMENT describes the segments which compose the transect line defined by the user. Specify a value of "-N", where N is an integer value, to cause the transect to have N intervals along its length. Specify a value of "0.0" to have the program determine the number of segments, by dividing the total length of the line by the longitude spacing in the CDF. Specify a value of "A", where A is a positive floating point value, to define the length in kilometers for each segment. Since the distance corresponding to one degree of longitude will vary as a function of latitude, the following information may prove useful:

At 80 degrees latitude, one degree longitude = 19.3 km
At 60 degrees latitude, one degree longitude = 55.6 km
At 45 degrees latitude, one degree longitude = 78.6 km
At 30 degrees latitude, one degree longitude = 96.2 km
At 0 degrees latitude, one degree longitude = 111.1 km
At any longitude, one degree latitude = 111.1 km

(12) OUTFN is the output file name containing the Surfer or Grapher-compatible (columnar) data. The format for this output ASCII file is:

Column 1: Point (sequence number) along section
2: Distance in kilometers along section
3: Latitude in degrees

4: Longitude in degrees
5: Level (i.e. depth) value
6: Parameter (data) value

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** AV2IMG
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** This proc ingests a TIROS satellite series AVHRR level 1b scene from a data tape in the format of those generated by NOAA/NESDIS/NCDC/SDSD (described in Kidwell, 1988). Several SEAPAK images may be created as specified by the parameter OUTPUT:

- Percent albedo image for visible channel 1
- Percent albedo image for visible channel 2
- Brightness energy temperature (deg C) image for IR channel 3
- Brightness energy temperature (deg C) image for IR channel 4
- Brightness energy temperature (deg C) image for IR channel 5 (if any)
- Sea-surface temperature (SST) image (deg C)

The algorithms for generating the visible and IR product images are described in NOAA Polar Orbiter Data Users Guide (Kidwell, 1988). The algorithm options for calculating the SST values are detailed in the help text of SST_EQN.

The tape file may be that of HRPT, LAC, or GAC data for any of the TIROS/NOAA series satellites. However, the data must be in packed format, with time incrementing, and be a full data set copy (as opposed to selective extract subsets where certain channels are selected). The NOAA Polar Orbiter Data Users Guide also contains all the specifications for the file format.

A file containing various information about the processing performed by this proc will also be generated if any output image is requested. This log file will have the extension ".AVH". See the help text for the parameter OUTNAME for more information about the convention for naming the output files.

A nonlinear calibration correction is applied to channels 4 and 5 for NOAA-9, 10, and 11 (Weinreb et al., 1990). This correction will therefore also impact the SST output image. However, if the line reduction factor (REDFAC(2)) is greater than four, this correction will not be applied. The reason for this exception is that data required for this correction are located piecemeal on consecutive scan lines with the pattern repeating every five lines. Reduction factors greater than four cause problems with aliasing of the data resulting from the subsampling. That is, the same (essential) parts of the data pattern may be missed from each repetition.

A time-dependent correction is applied to channels 1 and 2 for NOAA-7, 9, and 11 to account for deterioration of sensor sensitivity (Kaufman and Holben, 1991).

**PARAMETERS:**
(1) DRIVE is the name of the tape drive (the colon is optional). The tape must be physically mounted and the drive must be on-line; the drive must not be allocated (the DCL "MOUNT"

command) to you or to someone else. You should remove the write ring before mounting the tape on the drive in order to write-protect the data.

(2) SCENE is the number of the scene to be ingested. For example, the first scene on the tape is number 1, the second is number 2, and so on.

(3) SCAN is the index number for one of the following options:

1. The proc will run using the specified WINDOW and REDFAC values.
2. The proc will scan the specified scene on the tape in order to determine its first and last scan line numbers. The scan line limits will then be displayed and default values set for WINDOW and REDFAC. You will then be prompted for these parameters before proceeding with the scene's ingestion.
3. This is the same option as 2 except that the proc will proceed with the ingestion using the defaults without prompting you for WINDOW and REDFAC.

Options 2 and 3 are useful if you do not know the scan-line size of the scene in order to choose appropriate WINDOW and REDFAC values. For options 2 and 3, the WINDOW defaults for samples (data points along scan lines) will be WINDOW(1)=1 and WINDOW(3)=2048 for LAC data or WINDOW(3)=409 for GAC data; the horizontal (along scan) reduction factor, REDFAC(1), will be 4 for LAC data or 1 for GAC data. The defaults for the scan line WINDOW(2) and WINDOW(4) will be the first and last scan line numbers for the scene, respectively. The vertical (along orbital track) reduction factor, REDFAC(2), will be assigned according to the number of scan lines (NSCN) contained in the scene so as to fit all requested scan lines within the display with as few blank display lines as possible.

(4) REDFAC are the reduction factors for the horizontal (along scan) and vertical (along orbital track) directions, in that order. Positive values indicate reduction by subsampling whereas negative values indicate magnification by pixel replication. For example, an entry of (2,2) will create images half as wide in samples and half as high in scan lines as the scene area defined by WINDOW; an entry of (-2,-2) will generate images twice as high and wide. Note that reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Values of -1, 0, or 1 are equivalent and generate images having a one-to-one correspondence of pixels with the tape scene. See the help text for SCAN for more information on the use of REDFAC.

(5) WINDOW defines, in conjunction with REDFAC, the area of the tape scene to use for generating the SEAPAK images. WINDOW(1) and WINDOW(3) specify the positions of the first and last samples (data points along scan lines), respectively, to use from each scan line. WINDOW(2) and WINDOW(4) specify the first and last scan line numbers to ingest from the scene.

See the help text for SCAN for more information on the use of WINDOW.

Note that sample positions are numbered from the start of each scan. In scenes for which the satellite is ascending (flying south to north), sample 1 will be the easternmost sample of each scan; for descending scenes, it will be the westernmost sample. Also note that scan line numbers are those recorded with each scan line in the tape file of the scene. These may not necessarily start at 1 for a given scene depending on the specifications used for generating the tape file. However, scan line numbers are chronological, the lowest numbered scan line being the earliest in the scene.

To extract a certain area from an unfamiliar AVHRR scene, you may first ingest the entire scene with SCAN=2 or 3. The data limits within the output images and whether the satellite was ascending or descending will be indicated in the .AVH log file. These data limits are in terms of pixels and lines of an image display unit where pixel 1 is on the left and line 1 at the top. The first and last sample numbers and scan numbers and the sample and scan line reduction factors will also be found in the log file.

As an example, let's say that you have ingested this overview (entire) scene with a sample range of 1 to 2045 (LAC data) and scan line number range of 86 to 1487 with reduction factors of 4 for samples and 3 for scan lines. (Data limits would be 1 and 512 for pixels and 23 and 490 for lines.) We'll assume that, after displaying the overview, you wish to extract for greater detail a rectangular portion of data from it between pixels 100 to 150 and lines 130 to 200 (the display being 512 pixels by 512 lines).

The sample range (WINDOW(1) and WINDOW(3)) for the rectangle will be:

```
          (100) *4 - (4-1) =  397 and
          (150) *4 - (4-1) =  597 if descending
or    (512-150+1)*4 - (4-1) = 1449 and
      (512-100+1)*4 - (4-1) = 1649 if ascending
```

The scan line range (WINDOW(2) and WINDOW(4)) for the rectangle will be:

```
      (130- 23+1)*3 - (3-1) + (86-1) =  407 and
      (200- 23+1)*3 - (3-1) + (86-1) =  617 if descending
or    (490-200+1)*3 - (3-1) + (86-1) =  956 and
      (490-130+1)*3 - (3-1) + (86-1) = 1166 if ascending
```

The number of samples per scan line, 200, and the number of scan lines, 210, would then suggest reduction factors (REDFAC) of -2. The data in the resulting output images would be 400 pixels wide and 420 lines high.

(6) OUTNAME is a file name to use as the basis for the names of the output files created by this proc. If a device is not

specified, "SCRATCH:" will be used; if the device and the directory are not specified, the user's root (main) directory will be used. The extension ".IMG" will be used by default for the output image files if it is omitted from the file name. The name must be a valid host file name. For example, if all image files are created (see OUTPUT help), and OUTNAME = "AVHRRIMG", the files created will be named as follows:

```
SCRATCH:[acct]AVHRRIMGB1.IMG  \  % albedo img for visible
SCRATCH:[acct]AVHRRIMGB2.IMG  /  channels 1 and 2, resp.
SCRATCH:[acct]AVHRRIMGB3.IMG \   Brightness energy temp. (C)
SCRATCH:[acct]AVHRRIMGB4.IMG  >  imgs for IR chnls 3 and 4 and
SCRATCH:[acct]AVHRRIMGB5.IMG /   channel 5 (if any), resp.
SCRATCH:[acct]AVHRRIMGSST.IMG >  SST image (deg C).
SCRATCH:[acct]AVHRRIMG.AVH    >  AVHRR ingestion log file.
SCRATCH:[acct]AVHRRIMG.CTL    >  Navigatn control pt. file.
```

When using the proc READ to examine the data values of these output images, set TYPE=2 for the SST image and TYPE=12 for all the others.

(7) OUTPUT allows you to specify which SEAPAK output image to generate from the ingestion of the AVHRR level 1b tape scene. OUTPUT(n)="YES" will cause the image file corresponding to the index n to be created:

1. Percent albedo image for visible channel 1
2. Percent albedo image for visible channel 2
3. Brightness energy temperature (deg C) image for IR channel 3
4. Brightness energy temperature (deg C) image for IR channel 4
5. Brightness energy temperature (deg C) image for IR channel 5 (if any)
6. Sea-surface temperature (SST) image (deg C)

See the help text of OUTNAME for more information about the convention for naming the output files. See the main help text for information on calibration corrections.

(8) D2GSLOPE is the slope for converting output image data values into gray levels using the following scaling equation:

gray level = (data - D2GINTCP) * D2GSLOPE

The index of D2GSLOPE corresponds to that of OUTPUT--if OUTPUT(n)="NO", D2GSLOPE(n) will be ignored. For channels 1 and 2, data are in percent albedo; for all other output images, data are in degrees centigrade.

The minimum and maximum values for all requested output images will be printed in the log file. You can use these min/max values to help you choose D2GSLOPE and D2GINTCP values that maximize the contrast of desired features in the output images when rerunning this program. However, remember that

visual comparisons may be misleading for images that are of the same data type but have different scalings.

(9) D2GINTCP is the intercept for converting output image data values into gray levels using the following scaling equation:

gray level = (data - D2GINTCP) * D2GSLOPE

The index of D2GINTCP corresponds to that of OUTPUT--if OUTPUT(n)="NO", D2GINTCP(n) will be ignored. For channels 1 and 2, data are in percent albedo; for all other output images, data are in degrees centigrade.

The minimum and maximum values for all requested output images will be printed in the log file. You can use these min/max values to help you choose D2GSLOPE and D2GINTCP values that maximize the contrast of desired features in the output images when rerunning this program. However, remember that visual comparisons may be misleading for images that are of the same data type but have different scalings.

(10) SST_EQN specifies the index of an equation to use for calculating the sea-surface temperatures (SST) from AVHRR data. If SST_EQN=0, equation 2, 4, 5, 7, 8, 9, or 13 will be used depending upon the satellite and whether it is a day or nighttime scene. (For this purpose, the proc considers ascending scenes as day scenes and descending scenes as night scenes.) Recommendations for the use of the equations with the corresponding satellite and flight direction are given below.

In each equation, T(n) is the brightness energy temperature (see Kidwell, 1988, p.3-11) in degrees Kelvin for AVHRR channel n and sec(SZA) is the secant of the satellite zenith angle. Note that, if OUTPUT(6)="NO", specifying that no SST image be created, SST_EQN will be ignored. Otherwise, pixels for which SSTs will be calculated may be restricted by the value of the CLD_MIN input parameter.

1. SST = T(3)*C(1) + T(4)*C(2) + T(5)*C(3) + C(4)
   where C(n) are the values of the input parameter COEFS
   (generalized equation)
2. SST = 1.3826*T(3) - 0.31*T(4) - 291.26
   for NOAA-6, day or night (Bernstein, 1982, p.9461)
3. SST = 1.5*(T(3)-273.15) - 0.44*(T(4)-273.15) + 1.12
   for NOAA-6, day or night (McClain, 1981, p.2)
4. SST = 1.0346*T(4) + 2.5800*(T(4)-T(5)) - 283.21
   for NOAA-7, day (Strong and McClain, 1984, p.139)
5. SST = 1.0527*T(4) + 2.6272*(T(4)-T(5)) - 288.22
   for NOAA-7, night (Barbieri et al., 1983, p.20)
6. SST = 1.0170*T(4) + 0.9700*(T(3)-T(5)) - 276.58
   for NOAA-7, night (Strong and McClain, 1984, p.139)
7. SST = 3.6569*T(4) - 2.6705*T(5) - 268.92
   for NOAA-9, day (McClain et al., 1985, p.11600)
8. SST = 3.6535*T(4) - 2.6680*T(5) - 268.41

for NOAA-9, night (McClain et al., 1985, p.11600)

9. SST = 1.0155*T(4) + 2.5*(T(4)-T(5)) + 0.73*(T(4)-T(5))*(sec(SZA)-1) - 277.99
   for NOAA-11, day (MCSST day split-window; Walton et al., 1990, p.248)

10. SST = (T(4)-T(5)+0.789)*(0.19069*T(5)-49.16)/ (0.20524*T(5)-0.17334*T(4)-6.78) + 0.92912*T(5) + 0.81*(T(4)-T(5))*(sec(SZA)-1) - 254.18
   for NOAA-11, day (CPSST day split-window; Walton et al., 1990, p.248)

11. SST = (T(3)-T(5)+14.86)*(0.16835*T(4)-34.32)/ (0.20524*T(5)-0.07747*T(3)-20.01) + 0.97120*T(4) + 1.87*(sec(SZA)-1) - 276.59
   for NOAA-11, night (CPSST night triple-window; Walton et al., 1990, p.248)

12. SST = (T(3)-T(4)-6.44)*(0.17079*T(4)-58.47)/ (0.17334*T(4)-0.07747*T(3)-33.74) + 0.98530*T(4) + 1.97*(sec(SZA)-1) - 257.28
   for NOAA-11, night (CPSST night dual-window; Walton et al., 1990, p.248)

13. SST = (T(4)-T(5)+1.46)*(0.19596*T(5)-48.61)/ (0.20524*T(5)-0.17334*T(4)-6.11) + 0.95476*T(5) + 0.98*(T(4)-T(5))*(sec(SZA)-1) - 263.84
   for NOAA-11, night (CPSST night split-window; Walton et al., 1990, p.248)

(11) COEFS are the coefficients to use for the generalized equation for calculating sea-surface temperatures (SST). This parameter is used only if SST_EQN=1, specifying this equation which has the form

SST = T(3)*COEFS(1) + T(4)*COEFS(2) + T(5)*COEFS(3) + COEFS(4)

where T(n) is the brightness energy temperature (see Kidwell, 1988, p.3-11) in degrees Kelvin for AVHRR channel n.

Note that, if OUTPUT(6)="NO", specifying that no SST image be created, COEFS will be ignored even when SST_EQN=1.

(12) CLD_MIN is the minimum percent albedo which represents clouds in the channel 1 image. Pixels whose channel 1 albedo values are greater than or equal to CLD_MIN will have their SST image values set to absolute white (if OUTPUT(6)="YES"). The null value (default), "--", indicates that SSTs be calculated regardless of cloud values. The null value should be used for night scenes when the channel 1 visible image is not very meaningful.

(13) PROGRESS: If "YES", the number of the most recent scan line to be ingested will be displayed on the terminal at certain intervals.

**IIS BUTTON DEFINITIONS:**

No buttons are used.

**PROGRAM:** BATHY
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc allows one to overlay bathymetry or coastline data on the CZCS or AVHRR image currently displayed on the IIS. Limited regions and depths are available for the bathymetry data, whereas coastline data are available for any region of the world. The coastline data comes primarily in high resolution with various optional details, e.g. various size islands, political boundaries, etc. The images overlayed can be either mapped or unmapped, and have been displayed using IMAGE or WINDOW. If one is only interested in dropping coastlines, the proc COAST is more versatile and is recommended.

**PARAMETERS:**

(1) BATH is the bathymetry file name. One of the following file names should be entered if a REGULAR bathymetry file is specified (TYPE=1):

| File Name | Location |
|---|---|
| bath12.dat | gab20m (Georgia Bight) |
| bath14.dat | gab30m |
| bath15.dat | gab40m |
| bath30.dat | sab400m (S. Atl. Bight) |
| bath31.dat | sab500 |
| bath26.dat | sab1000f |
| bath27.dat | sab100f |
| bath28.dat | sab10f |
| bath29.dat | sab20f |
| bath32.dat | sab50f |
| bath33.dat | sabbahama |
| bath34.dat | sabshr |
| bath35.dat | spn20m (N.W. Spain) |
| bath36.dat | spn50m |
| bath37.dat | spnisl |
| bath38.dat | spnshr |
| bath23.dat | glf50f (W. Fl. shelf) |
| bath24.dat | glfisl |
| bath25.dat | glfshr |
| adrc.dat/adri.dat/adri2.dat | Adriatic sea coast/islands/more islands |
| nac.dat/nai.dat | North America coast/islands |
| sawc.dat/sawi.dat/sawi2.dat | South America west coast/islands |
| maine.dat | Maine coast/islands |
| carib.dat | Caribbean coast/islands |
| bering1/2.dat | Bering Sea coast/islands-America/Asia |

This parameter is ignored for the WDB-II CIA coastline files, i.e where TYPE=2. The directory specifications are automati-

cally attached to the BATHY file name so it points to the current location of these files.

(2) LON_RNGE is the longitudinal limits of the image in degrees. The western limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used.

(3) LAT_RNGE is the latitudinal limits of the image in degrees. The northern limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used.

(4) GPLANE is the graphics plane to use for the bathymetry or coastline overlay.

(5) TYPE specifies whether the bathymetry or coastline file is a regular file or a CIA WDB-II file. The value for TYPE is:

1 for a regular bathymetry file,
2 for a CIA WDB-II coastline file.

In a regular bathymetry file, each record of the file contains four pairs of latitude/longitude information and is contiguous with the previous record. When a special gap record is encountered, the file is terminated. The CIA WDB-II coastline file provides global coverage of coast, islands and lakes. If this is selected, the user will be prompted for two other parameters when the proc is executed. The first parameter is called INDEX. INDEX specifies what level of detail the user would like to see. One should enter an index for each level of detail one wants to see:

WDB-II coastline index(es)
1 major coast/islands/lakes
2 additional major islands/lakes
3 intermediate islands/lakes
4 minor islands/lakes
6 intermittent major lakes
7 intermittent minor lakes
8 reefs
9 major salt pans
10 minor salt pans
13 major ice shelves
14 minor ice shelves
15 glaciers

The second parameter that one is prompted with when the CIA database is used is SSRATE. SSRATE is the subsampling rate for the corresponding INDEX. An SSRATE value of n indicates that only every nth data base value will be used. For most applications, the maximum (default) value should be adequate and will greatly reduce the amount of time required for the proc to run.

(6) FILL indicates whether or not one wants to fill in an area to the left or right of the bathymetry or coastline that is to be

drawn. One should enter a 0 if one just wants the line with no filling to take place. If one intends to have the coastline or bathymetry fill to the right edge of the image, enter a 1. If one intends to have the coastline or bathymetry fill to the left edge of the image, enter a 2.

**IIS BUTTON DEFINITIONS:**
No buttons are used in BATHY.

**PROGRAM NAME:** BINDRIFT
**DATE:** 4/15/91
**MENU:** UNGRIDANL

**DESCRIPTION:** This program allows the user to define a grid and time periods for binning drifter track data from the SEAPAK environmental data archive. The inputs to this program can be either an ASCII file output by RDDRIFTER (with the measured data along a group of tracks) or an ASCII file output by DRIFTER (with the computed movement information based on the locations along a group of tracks. Optionally, an ASCII drifter list file can be specified (when RDDRIFTER output is specified) to speed up processing. Time periods for binning can be either a discrete set of times (up to 50) or up to 25 start/end ranges. After specification of a parameter mnemonic (or two mnemonics for u and v wind components), the program can compute the mean, standard deviation or number of observations of the specified parameter within the grid and times specified, outputting an ASCII grid in SEAPAK environmental data format for each type of computation requested. For specification of u and v, eddy kinetic energy can also be computed. The ASCII output is compatible with SEAPAK program GEMPLOT for plotting contours or wind vectors/barbs/streamlines, and ENVIMG for generating gray level images.

**PARAMETERS:**
(1) INASC is the filename for the ASCII input drifter data. This ASCII file is either output from program RDDRIFTER (if INTYPE=1) or output from DRIFTER (if INTYPE=2).
(2) INTYPE is the file type for INASC. Specify a value of 1 to indicate that INASC is an output from RDDRIFTER, or specify a value of 2 to indicate that INASC is an output from DRIFTER. RDDRIFTER output contains a group of header lines followed by measured data, for each drifter track. DRIFTER output contains exclusively speed and heading information computed from the locations along each track.
(3) INLIST is the optional filename for the ASCII drifter list (non-data) from RDDRIFTER. This contains just a list of drifters located in INASC, their start/end times, number of records, etc. but no data. It is created optionally when running RDDRIFTER. However, specifying its name here when INTYPE=1 will greatly speed execution of this program, since without it the heading of every drifter track in INASC must be read to determine if the track falls within the spatial/temporal limits specified by LAT, LON and TIMES.
(4) TIMES is an array of up to 50 times to use in binning the data, each in YYMMDDHH format. If left null, no time restrictions will be applied; that is, all data records falling within the spatial restrictions specified by LAT and LON will be included in binning. Otherwise, if TIMTYP=1, times specified here are treated as discrete times and only drifts at these times will be included in the binning. If

TIMTYP=2, each group of two times is treated as a range and all drifts falling between each set of times will be included in binning.

(5) TIMTYP is the type of input for TIMES. Specify a value of 1 to indicate that TIMES are discrete time values or specify a value of 2 to indicate that TIMES are a series of paired start/end ranges. If TIMTYP=1, times specified in TIMES are treated as discrete times and only drifts at these times will be included in the binning. If TIMTYP=2, each group of two times is treated as a range and all drifts falling between each set of times will be included in binning.

(6) LAT are the latitude bounds for binning. Specify the south boundary in LAT(1) and north boundary in LAT(2). These values, together with LON and DELTA_LL, define the grid for binning.

(7) LON are the longitude bounds for binning. Specify the west boundary in LON(1) and east boundary in LON(2). These values, together with LAT and DELTA_LL, define the grid for binning.

(8) DELTA_LL are the grid spacings in latitude and longitude for binning. Specify the latitude spacing in DELTA_LL(1) and the longitude spacing in DELTA_LL(2). A grid will be generated using the specified spacing and the values of LAT and LON, to be used for binning the drifter data.

(9) PRMBIN are the values of one or two mnemonics representing parameters to be binned (from INASC). All data for the parameter(s) meeting the spatial and temporal limits will be included in the computations within each grid bin. If two values are specified, the data in INASC is assumed to be zonal and meridional components of wind (originating in the ASCII track movement file) and the gridded, binned values for u and v will be written to the same file for use with GEMPLOT (ENVIMG only handles scaler fields) if OUTTYP(1) = 1. Note that mnemonics U and V must be specified in order to compute eddy kinetic energy (OUTTYP(4) = 1), since they are both needed in its computation (therefore eddy kinetic energy should be requested in a separate run if other parameters are desired for computing mean, standard deviation or number of observations). For eddy kinetic energy, a single output file will be written with the scaler eddy kinetic energy values. Acceptable values for PRMBIN include: SFTMP, SALIN, BDPT, AIRTMP, SLPRESS, WD_DIR, WD_SPD, QC_SST, QC_PRS, QC_LOC, E_VEL, N_VEL, N_ACCEL, QC_PROC, SPD, U, V and HEADING. See program RDDRIFTER for an explanation of these mnemonics.

(10) OUTASC is the filename of the ASCII output in SEAPAK environmental data format. This file contains the results of binning the drifter data and computing the mean, standard deviation, eddy kinetic energy or number of observations in grid boxes, depending on the values of OUTTYP. For files containing the mean value, the filename of OUTASC specified is appended by _MEAN; likewise, for files containing the standard deviation, eddy kinetic energy and number of observations, OUTASC's filename is appended by _STD, _EKE and _OBS respectively. If

no filetype is specified, .ASC will be used by default; if no directory is specified for the file, it will be written to the user's home directory on disk SCRATCH:.

(11) OUTTYP is a set of flags indicating the type of computations to be done to create OUTASC. Specify a 1 in OUTTYP(1), OUTTYP(2), OUTTYP(3), or OUTTYP(4) to compute the quantity, or specify a 0 not to compute the quantity. OUTTYP(1) represents the mean over the grid, OUTTYP(2) the standard deviation, OUTTYP(3) the number of observations, and OUTTYP(4) the eddy kinetic energy.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** BLKGRD
**DATE:** 4/15/91
**MENU:** GEM4LIST

**DESCRIPTION:** This program is used to insert a GEMPAK4 missing data flag at locations in a grid falling over land, in order that contours generated from this grid do not extend over land areas. The input grid is an ASCII file generated by GEMPAK4 program GDLIST. The output is another ASCII file with blanking over land areas, with the determination of land vs. sea made by reading the NORDA 5 minute resolution digital bathymetry data base. This output grid can then be loaded into the GEMPAK4 binary grid file using GEMPAK4 program GDEDIT for plotting.

**PARAMETERS:**
(1) INGRID are the names of up to 50 GEMPAK4 ASCII grids to be blanked.
(2) OUTGRD are the names of up to 50 blanked GEMPAK4 ASCII grids corresponding to the names in INGRID.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** BLOTCH
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** This proc provides button functions for defining polygon regions on graphics planes and filling them in ("blotches"). The polygon may be concave or convex, and the lines are allowed to cross. The interior or the exterior of a polygon may be filled in to define a blotch.

**PARAMETERS:**
(1) PLANE is the number (1-7) of the graphics plane on which to draw a blotch. The graphics plane may be changed using the "Start next plane" button (D2).

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick new vertex | Delete last vertex | Close and fill interior | Close and fill exterior | Exit |
| 2 | Define rectangle for blotching | Erase incomplete polygon | Clear current plane | | |
| 1 | Display cursor position | | | | |

A1: Displays the pixel/line (TV coordinates) of the cursor position.
A2: Allows you to define a rectangle for blotching without having to position the cursor. You may then use buttons C3 or D3 to close and define the blotch.
  1) SP is the starting pixel position (1 to 512).
  2) SL is the starting line position (1 to 512).
  3) EP is the ending pixel position (1 to 512).
  4) EL is the ending line position (1 to 512).
A3: Mark the cursor position on the current graphics plane as a new vertex of the polygon being defined for blotching.
B2: Erase the incomplete polygon in the current plane--i.e., a polygon for which button C3 or D3 has not been used.
B3: Delete the vertex previously marked by button A3 on the current plane.

C2: Clears the current graphics plane; any graphics on that plane will be lost.
C3: Close and fill in (blotch) the interior of the polygon.
D2: Increments the current graphics plane by one. If that plane is 7, it will be set to 1.
D3: Close and fill in (blotch) the exterior of the polygon.
F3: Exits this proc.

**PROGRAM NAME:** BPCOLOR
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** BPCOLOR allows the user to set the colors of the IIS graphics planes to ones that are more suitable for their application. There is a palette of 15 colors to choose from. BPCOLOR can also be used to clear selected planes or turn them off.

**PARAMETERS:**

(1) PLANES defines the graphics planes to change. This parameter must be entered without separators, for example:

PLANES = 135 implies that graphics planes 1,3 and 5 are reset.

PLANES = 1234567 implies that graphics planes 1,2,3,4,5,6 and 7 are reset. Note that there are no spaces between values.

(2) COLOR is a list of colors for the graphics planes listed in PLANES. These are entered as a list with blanks or commas as separators. Only the first two letters of the color should be entered. Current valid colors are:

| | | | |
|---|---|---|---|
| RE | red | BR | brown |
| GR | green | PI | pink |
| BL | blue | GY | gray |
| YE | yellow | WH | white |
| CY | cyan | MA | magenta |
| OR | orange | TA | tan |
| SA | sand | LG | light green |
| BK | black | | |

The following are also valid entries for COLOR:

OF graphics plane is turned off.
CL graphics plane is erased.

If the list of colors is shorter than the list of planes, the last color is repeated. For example, if

PLANES=1234567 and COLOR=(GR,BL,RED)

then plane 1 is set to green, plane 2 is set to blue, and planes 3, 4, 5, 6, and 7 are set to red. Note that if an invalid color is entered, no action is taken.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this proc.

**PROGRAM NAME:** BPEDIT
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** This proc provides various button functions for editing graphics for the IIS image display.

**PARAMETERS:**
There are no initial input parameters.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | BLOTCH: Def./clear and change GR plane(s) | Modify interior or exterior of blotch pl. | | Draw box | Exit |
| 2 | ANNOTATE: may reset color on GR planes | GR planes: set color on/off/ clear | BPSAV: GR create, insert, display | Cursor position | Cursor on/off |
| 1 | Display another channel | Drop a new image | List channels and images | Draw tick marks | Load look-up table |

A1: Displays a specified channel.
  1) NEW_CHAN is the number (1 to 14) of the new channel to display.

A2: Invokes the proc ANNOTATE. Pressing F3 ("Exit") on that menu will reset this menu.

A3: Invokes the proc BLOTCH. Pressing F3 ("Exit") on that menu will reset this menu.

B1: Drops an image into a specified channel.
  1) FILENAME is the name of a disk file containing an image. This image will be dropped into the image display refresh memory specified by CHANNEL. Note that any image contained in CHANNEL will first be deleted. You may use button C1 to list the images currently loaded in the display channels and to determine the empty channels. FILENAME cannot be a full-width image. Such images must be dropped using the proc WINDOW prior to invoking BPEDIT. The extension ".IMG" will be used by default if it is omitted from the file name.
  2) CHANNEL is a channel number (1 to 14) in which to drop the image FILENAME.

B2: Allows the user to set the colors of the IIS graphics planes. It may also be used to clear planes or to turn them off.

1) PLANES is a list of graphics planes with no separators. For example, LANES="1234".
2) COLOR is an array of colors corresponding to the PLANES list. Valid colors are:

| | | | |
|---|---|---|---|
| OF | graphic plane is turned off (made invisible but not erased). | | |
| CL | graphic plane is erased (cannot be recovered). | | |
| RE | red | BR | brown |
| GR | green | PI | pink |
| BL | blue | GY | gray |
| YE | yellow | WH | white |
| CY | cyan | MA | magenta |
| OR | orange | TA | tan |
| SA | sand | LG | light green |
| BK | black | | |

If the number of colors is less than the number of planes, the last color specified will be used for the remaining planes.

B3: Allows the user to modify the interior or exterior of the blotch plane(s).

1) PRBP is the primary blotch plane. No portion of it will be deleted.
2) SEBP: The absolute values of SEBP (1 to 7) are the secondary blotch planes, parts of which are to be deleted. If >0, interior portions of abs(SEBP) that overlap with PRBP will be deleted. If <0, exterior portions of SEBP that overlap with PRBP will be deleted. Note that abs(SEBP) cannot be the same as PRBP.

C1: Displays the names of any images currently loaded in the refresh memories and the number of the channel currently displayed.

C2: Invokes the proc BPSAV for saving or displaying graphics.

D1: Draws tick marks.

1) SP is the starting pixel of the tick mark base line.
2) SL is the starting line of the tick mark base line
3) NP is the number of pixels for the length of a horizontal tick mark base line. See NL.
4) NL is the number of lines for the length of a vertical tick mark base line. If NP=0 and NL>1, a vertical base line is drawn; if NP>1 and NL=0, a horizontal line is drawn. If NP>1 and NL>1, a diagonal base line with no tick marks is drawn.
5) HTICK: Enter 0 for no tick marks (base line only); >0 for tick marks drawn toward the right or upward; <0 for tick marks drawn toward the left or downward.
6) GPLANE specifies the graphics plane (1 to 7) to use.

D2: Displays the pixel/line (TV) coordinates of the current cursor position.

D3: Allows the user to draw a rectangle specifying parameters or using a function button.

1) SP is the starting pixel position. If either SP=0 or SL=0, the user will be notified to push button D3 to determine the starting position.
2) SL is the starting line position. If either SP=0 or SL=0, the user will be notified to push button D3 to determine the starting position.
3) NP is the pixel width of the rectangle. If either NP=0 or NL=0, the user will be notified to push button D3 to determine the ending position.
4) NP is the line height of the rectangle. If either NP=0 or NL=0, the user will be notified to push button D3 to determine the ending position.
5) WIDTH determines the thickness of the rectangle's perimeter. If WIDTH > 1, WIDTH-1 additional lines will be drawn adjacent to and inside of the perimeter line.
6) GPLANE is the graphics plane (1 to 7) to use for drawing the rectangle.

F1: Invokes the proc TABLOAD for loading a look-up table.
F2: Toggles the cursor on and off.
F3: Exits this proc.

**PROGRAM NAME:** BPINIT
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** BPINIT is a proc used to initialize the IIS graphics planes. This means that they are turned back on (if they had been turned off) and reset to the default colors. The default colors are:

| Plane | Color |
|---|---|
| 1 | pink |
| 2 | red |
| 3 | green |
| 4 | yellow |
| 5 | orange |
| 6 | cyan |
| 7 | sand |

**PARAMETERS:**
There are no input parameters.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** BPSAV
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** This proc will save specified graphics planes from the IIS Model 75 graphics channel into a disk file or display such a graphics image file on the graphics channel. When saving, the graphics planes to be read from the IIS and the planes into which to save them in the file may be specified. Similarly when displaying, the planes to read from the file and the planes into which to display them may be specified. In addition, when saving graphics planes, the displayed graphics may be saved in a new file or inserted into (in other words, combined with or added to) an existing graphics file. The IIS Model 75 image display must first be allocated (proc ALLOC).

**PARAMETERS:**

(1) GRF_FILE is the name of the disk graphics image file to create (OPTION="CREATE"), to use for inserting (OPTION="INSERT"), or to display (OPTION="DISPLAY"). The extension ".BLO" will be used by default if it is omitted from the file name.

(2) OPTION: Enter any of the following options:

CREATE: Creates GRF_FILE into which the requested planes are output.

INSERT: Inserts the requested planes into GRF_FILE. A new version of GRF_FILE is actually created which contains its previous graphics plus those of the "inserted" planes. If an OUT_GP of GRF_FILE already contains graphics, that plane will contain those graphics plus the "inserted" graphics.

DISPLAY: The requested graphics will be displayed from GRF_FILE. NOTE: If an OUT_GP of the graphics channel already contains graphics, that plane will be cleared before that "inserted" plane is displayed.

"C", "I", or "D" is sufficient to specify the option.

(3) IN_GP are up to seven input graphics plane numbers with values of 1 to 7. The null value "--" (default) indicates all graphics planes (1 to 7) in consecutive order. If OPTION= "CREATE" or "INSERT", IN_GP indicates the planes which will be read from the display unit and output to GRF_FILE according to OUT_GP. If OPTION="DISPLAY", IN_GP indicates the planes which will be read from GRF_FILE and displayed according to OUT_GP.

(4) OUT_GP are up to seven output graphics plane numbers with values of 1 to 7. The null value "--" (default) indicates the same planes in the same order as those of IN_GP. OUT_GP values have a one-to-one correspondence with those of IN_GP. Therefore the number of OUT_GP values must match the number of IN_GP values (unless OUT_GP=--). Note that if IN_GP=--,

indicating all planes, OUT_GP must have seven values specified or be the null value.

OUT_GP represents the plane numbers into which the corresponding IN_GP planes will be output. For example, if IN_GP(3)=6 and OUT_GP(3)=2, the sixth plane read from the display unit will be output to the second plane of GRF_FILE (if OPTION="CREATE" or "INSERT") or the sixth plane read from GRF_FILE will be displayed to the second plane of the display unit (if OPTION="DISPLAY").

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** BTHGRD
**DATE:** 4/15/91
**MENU:** GEM4LIST

**DESCRIPTION:** This program is used for inserting a land flag at points below the bottom depth of profiles represented in a hydrographic data ASCII grid. The grid list is assumed to have been created by GEMPAK4's GDLIST program. The original grid is created by SEAPAK program ASC2GEM, followed by GEMPAK4 programs SFCFIL, SFEDIT, OAGRID and OABSFC. This grid is used ultimately to draw cross sections, where the "latitude" dimension of the grid is depth and the "longitude" dimension is profile number. GEMPAK4 program GDCNTR is used to draw the section. The bottom depths are obtained from a hydrographic data station list produced by programs RDNODCSD, RDNCSDBA, RDXBT, RDXBTBA, RDSKDWAY or RDSKDBA. By inserting the land flag at the appropriate points, the cross section plot will more closely reflect the actual bottom topography. The revised grid ASCII file specified in OUTGRD should be inserted in the binary file using GDEDIT before running the cross section.

Note that the land flag used is -9999.9, which is NOT the GEMPAK4 land flag of -9999.0. This is done purposely, in order to allow the user to contour the bottom bathymetry on the plot if desired. Using GEMPAK4 program GDCNTR, the user could specify a contour value for CINT which falls between the smallest real data value on the grid and the flag -9999.9 to obtain the bathymetry contour.

**PARAMETERS:**
(1) STNLST is the name of the hydrographic data station list file. This file is created along with the data file in one of the programs: RDNODCSD, RDNCSDBA, RDSKDWAY, RDXBT, RDXBTBA, and contains a list of the stations, their latitude/longitude, time of the profile, and the station bottom depth.
(2) GRID is the name of the GEMPAK4 ASCII file to revise (input). This file is obtained as output from GEMPAK4 program GDLIST.
(3) OUTGRD is the name of the revised GEMPAK4 ASCII grid (output). This file should be loaded into the GEMPAk4 binary grid file representing the hydrographic cross section, using GEMPAK4 program GDEDIT.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** BZONE
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** This proc outputs, to an ASCII file, ocean productivity related figures for specified regions of a pigment image. The user first defines the vertices (maximum 7) of each polygon shaped region (maximum 6) by latitude/longitude and the range of gray level in the image file to be masked as the ocean part of these regions. Then the proc will do the calculations based on these masked areas. The pigment in the input image can be calculated from either the Miami DSP equation:

```
PIGMENT = 10. ** (0.012 * GRAY - 1.4)
```

or the SEAPAK equations:

```
if (GRAY .le. 136), then
    PIGMENT = 10. ** (136 - GRAY) / 98.38
else,
    PIGMENT = 10. ** (GRAY - 136) / 74.17
```

The ocean productivity related parameters that are calculated for output include:

1) Ntot - the total pixels in the masked area, i.e. the number of possible ocean pixels.
2) Nval - the total valid pixels, i.e. the total pixels with 0 and 255 excluded. This throws out pixels where no data exists or is cloud covered.
3) VP - the area for the valid pixels in Km**2; VP = Nval*Cos(Lat)*AREAP.
4) TP - the area for the total ocean area in the region of interest in Km**2; TP=Ntot*Cos(Lat)*AREAP
5) PIG - the mean pigment concentration determined from valid pixels in mg/m**3; PIG=SUM(CHLOR)/Nval where the SUM ranges over all Nval and CHLOR is the chlorophyll concentration at a valid pixel.
6) PP - the mean primary productivity in gmC/m**2/Day; PP = SUM(SQRT(CHLOR))/Nval where the SUM ranges over all Nval, CHLOR is the chlorophyll concentration at a valid pixel and AP is the area for a pixel at that latitude.
7) PIGtot - the total pigment in the ocean area of the defined region in kg pigment/m; PIGtot=PIG*TP
8) PPtot - the total productivity in the oceanic region masked off in kgC/day; PPtot=PP*TP
9) F - is the ratio of new production to total production; F = SUM(0.26+(0.65*SQRT(CHLOR)/(SQRT(CHLOR)+1.465)))/Nval where the SUM ranges over all Nval and CHLOR is the chlorophyll concentration at a valid pixel.

10) Sinking Flux - is given in tonsC/day; Sinking_Flux = (SUM( (0.26+(0.65*SQRT(CHLOR)/(SQRT(CHLOR)+1.465)))*SQRT(CHLOR))/ Nval)*TP where the SUM ranges over all Nval.

It should be noted that this proc can be run with or without the use of an IIS depending on user input.

**PARAMETERS:**

(1) IMGFIL is the input pigment image file name. This image can be either a SEAPAK or a MIAMI DSP pigment image.
(2) HDRBLK is the number of header blocks in the input image file.
(3) PIGMENT is a flag indicating whether the input image file uses a Miami DSP or a SEAPAK pigment scaling method. One should enter a "1" for a Miami DSP image and a "2" for a SEAPAK image.
(4) AREAP is the area per pixel in kilometers squared.
(5) GLEVEL is the range of gray levels to be masked off as the ocean part of the regions defined by R1 to R6.
(6) OUTFIL is the output ASCII file name containing the ocean productivity related figures for the specified regions of the input pigment image. It contains the values listed in the Description section above.
(7) DSPFLAG is a flag indicating whether or not to display the image on an IIS. Enter a "0" if one does not have access to an IIS or simply does not want to display the image and masked areas. Enter a "1" to display the image as well as the masked and unmasked areas. Make sure an IIS has been allocated, if "1" is selected.
(8) LAT is the range of latitude in the image file. The northern most value followed by the southern most value need to be entered.
(9) LON is the range of longitude in the image file. The western most value followed by the eastern most value need to be entered.
(10) R1 defines the first of six polygon regions to be analyzed. A pair of latitude/longitude values (maximum of 7 pairs) should be entered for each vertex of the region of interest in the image file. The latitude should be entered before the longitude value in each of these pairs.
(11) R2 defines the second of six polygon regions to be analyzed. The same comments given for R1 apply here as well.
(12) R3 defines the third of six polygon regions to be analyzed. The same comments given for R1 apply here as well.
(13) R4 defines the fourth of six polygon regions to be analyzed. The same comments given for R1 apply here as well.
(14) R5 defines the fifth of six polygon regions to be analyzed. The same comments given for R1 apply here as well.
(15) R6 defines the sixth of six polygon regions to be analyzed. The same comments given for R1 apply here as well.

**IIS BUTTON DEFINITIONS:**
If DSPFLAG=0, no buttons are used. If DSPFLAG=1, then the following button menu is displayed.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Blotch Area Display Toggle | Ocean Masked Blotch Area Display Toggle | Display Output File On Screen | | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button toggles on/off the blotch of the region(s) of interest as defined with the parameters R1, R2, R3, R4, R5, and R6.

B3: This button toggles on/off the blotch covering the ocean area (as defined by GLEVEL) in the region(s) of interest.

C3: This button enables the user to display the output file containing the data computations on the terminal screen. To output the data to a line printer, one must use the standard DCL PRINT command.

F3: This button exits the proc.

**PROGRAM NAME:** CACEXT
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program allows extraction of individual months of CAC SST data from larger groupings on disk, identical to the original tape format. The data was received from the NASA Climate Data System. The format is: file 1: Atlantic and Pacific means; file 2: Atlantic and Pacific anomalies; file 3: global means; file 4: global anomalies. One file per month/data type/region is created. Naming convention is as follows: "Year/month.CAC/region/type". For example, 781.CACATLANOM is the name of a file containing Jan, 1978 Atlantic ocean anomalies. Likewise, 8510.CACGLBMEAN would contain global means for Oct., 1985. Output files contain 128 floating point values per 512-byte block. Atlantic and Pacific regions contain 5151 values, composed of 101 longitudes between 100 W and 100 E and 51 latitudes between 40 S and 60 N (i.e. values 1 through 101 are for 40 S, longitudes 100 W to 100 E; 102 through 202 for 38 S, longitudes 100 W to 100 E, etc.). Atlantic and Pacific data is monthly from January 1970 to December 1984. Global data is from January 1982 to November 1986 and consists of 180 longitudes proceeding eastward from 0 degrees, and 91 latitudes proceeding northward from 90 S. Two-degree resolution is maintained in both the global and ocean basin data. The oceanic regional data is based on in situ data only, while the global is a blend of in situ and satellite data.

Before running this program, the tape utility MTU should be used to dump each tape file to disk, using 4,000-byte fixed length records. This program will ordinarily be run just once for each new data tape received. It is also strongly suggested that this program be run as a batch job under TAE since it takes over an hour to run to completion.

**PARAMETERS:**

(1) FILES is the input file specifications (specify 4 - first 2 are for ATL/PAC, last 2 for global data).

(2) OUTDIR is the directory to hold the output files. Be sure you have enough disk quota remaining in this directory. Space needed depends on the number of months of data on the tape. Each Atlantic or Pacific data set takes up 41 blocks; each global data set 128 blocks, so the total needed is:

(Total number of months of Atlantic/Pacific data) x 2 (ocean basins) x 2 (means,anomalies) x 41 (blocks) + (Total number of months of global data) x 2 (means,anomalies) x 128 (blocks) or 5,040 blocks/year of data.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** CDF1D2GM
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program is used for converting a one-dimensional Common Data Format (CDF) file to GEMPAK4 surface format. It is assumed that the user has run CDFLST or another listing program, and is familiar with the attributes of the CDF (parameter number, type, range, etc.). The CDF must contain LATITUDE, LONGITUDE, and date/time expressed as EPOCH (a CDF attribute that expresses time in terms of milliseconds from a reference time of January 1, 0 AD).

The user must specify the variable number, data type, and scaling factor for each input parameter. Other input information requested includes the observation frequency, the starting/ending dates and times, and the starting/ending station numbers. The output generated by CDF1D2GM includes three ASCII files required in creating a GEMPAK4 surface file. The user must use these files as input for GEMPAK4 programs SFCFIL and SFEDIT to initialize a surface file and load it with data (refer to environmental data scenarios for examples using these programs).

**PARAMETERS:**

(1) CDF_NAME is the fully-qualified name (excluding filetype) of the one-dimensional CDF file to be converted into a GEMPAK4 surface file. CDF1D2GM accepts only one input file.

(2) SURFACE is the prefix portion of the name for the three output ASCII files necessary for creation of GEMPAK4 surface files. The filetypes (suffixes) are automatically affixed as SFLIST, SFSTN, and SFPACK. If an output device is not specified, the files will be written to a scratch disk. For example if the user enters TEST, TEST.SFLIST, TEST.SFSTN, and TEST.SFPACK will be created on SCRATCH.

(3) NVARS is the number of parameters (between four and seven) to be ingested from the CDF. A minimum of four input parameters is required to insure adequate information (LATITUDE, LONGITUDE, SITE_ID, and EPOCH) for GEMPAK4 routines. A maximum of seven parameters is imposed allowing the processing of three data parameters in addition to the four required parameters. On occasion SITE_ID may be missing from the CDF. For these situations VARS and V_TYPE (see below) must be flagged and a SITE_ID will be created using sequential integers (values less than or equal to 9999) or four-character alphabetic representations (values greater than 9999).

(4) VARS contains the variable numbers of the parameters to be extracted from the CDF. These values can be obtained by running CDFLST or other unsupported listing programs. A minimum of four and a maximum of seven input parameters are required. The variable numbers must appear in the following order:

```
(1)        LATITUDE #
(2)        LONGITUDE #
(3)        SITE_ID #
  .              .
  .              .
  .              .
(NVARS)    EPOCH
```

If SITE_ID is missing, a zero must be entered for (3) (see V_TYPE below). As a typical example, assume LATITUDE is the second CDF parameter, LONGITUDE the third, SITE_ID the first, and EPOCH the eleventh, then the following should be entered:

```
(1)  2
(2)  3
(3)  1
(4)  11
(5)  -
(6)  -
(7)  -
```

(5) V_TYPE is the list of variable types (obtained from CDFLST) corresponding to the parameters specified in VARS. The position of the parameter (variable) type in the V_TYPE list must correspond exactly with the position of the parameter in the VARS list. Missing parameters must be flagged with a zero. The following are the parameter types codes to be used:

```
1          BYTE
2          INTEGER*2
3          INTEGER*4
4          REAL*4
5          REAL*8
```

Using the example listed above in VARS, if latitude/longitude is Real*4, EPOCH is Real*8, and Site_Id is Byte, then the following should be entered:

```
4          (1)
4          (2)
1          (3)
5          (4)
-          (5)
-          (6)
-          (7)
```

(6) SCALE is a scaling factor to be applied to the input data. Scaling can range from 0.001 to 1000.0. The position of the scaling factor in the SCALE list must correspond exactly with the position of the parameter in the VARS list. Scaling may be required since parameters are written in the surface ASCII files with Fortran F8.2 format (8 total digits, 2 places right

of decimal). The user should be careful to avoid output conversion errors and loss of information.

(7) PRMSEL is a listing of the four-character names to appear in the output GEMPAK4 surface file. The output names should be entered in the same order as the corresponding input parameters in VARS. A total of NVARS-1 names are required since date/time is written automatically (do not include EPOCH as one of the output names).

(8) PERIOD is the frequency of observations for the input CDF. It can assume one of the following values:

HOURLY
DAILY
MONTHLY
ANNUAL

(9) SDATE is the starting date of the data the user wishes to extract from the one-dimensional CDF. It must be expressed in the form: YYMMDDHH (i.e. 86020112 for Feb. 1, 1986 at 1200 hours).

(10) EDATE is the ending date of the data the user wishes to extract from the one-dimensional CDF.

(11) SSTN is the starting station number of stations the user wishes to process from the CDF.

(12) ESTN is the ending station number of stations the user wishes to process from the CDF.

(13) DEVICE specifies the location of the input CDF. The CDF may be located on an optical drive or a magnetic disk (on-line). If an optical drive is designated it will be mounted automatically. The following are the valid options:

| | | |
|---|---|---|
| LDB0 | : | Data on drive LDB0 of DIATOM |
| LDB1 | : | Data on drive LDB1 of DIATOM |
| null | : | This indicates the data is on-line (magnetic disk). |

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** CDFDRIFT
**DATE:** 4/15/91
**MENU:** CDFIN

**DESCRIPTION:** This program will create a Common Data Format (CDF) group of files containing Richardson (WHOI) shipdrift climatology data. This data consists of monthly and annual grids with 2x5 (latitude, longitude) degree resolution, for the following parameters: mean zonal wind, mean meridional wind, uprime*vprime, zonal wind variance, meridional wind variance, and eddy kinetic energy. The original data consisted of 208 files, or 13 groups of 16 (means for each month of the year and an annual mean, for each of 16 Canadian rows from 80S to 80N - each row is a 10 degree latitude band). These were numbered sequentially and called "SHIPDRIFT01.DAT"...through "SHIPDRIFT208.DAT" on disk. This program only needs to be run again if the data is ever updated or modified.

**PARAMETERS:**
(1) INFILE is the filename for the input (disk) files with WHOI drift data, including the directory location (do not include a sequence number or filetype)
(2) OUTCDF is the filename for the output CDF to contain WHOI drift data (filetype excluded).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** CDFLST
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program allows you to list characteristics of, or data from, a file in the NSSDC Common Data Format (CDF). Data resolutions of up to 512 latitudes by 512 longitudes are supported. Output can be sent to either the terminal, system printer, or a specified file, or any combination of these. The user can continue to specify new options and run them without exiting the program. Data can reside on magnetic disk or the SONY WORM optical drive.

**PARAMETERS:**

(1) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(2) DEST is the destination of the output designated by CHOICE. For terminal output, enter a "T"; for printer output, enter a "P"; for file output, enter an "F". Up to three choices for DEST can be entered at one time.

(3) CHOICE specifies what one desires to retrieve from the CDF file. Up to four numbers in the range 1 to 5 may be entered. Enter a "1" to list the overall dataset contents. This includes the number of dimensions, size of these dimensions, number of records, number of variables, and number of attributes. Enter a "2" to list the characteristics of variables and attributes. For variables, this includes mnemonic name, variable number within data set, FORTRAN data type, number of bytes per data point, record variance (True/False), and dimensional variance (True/False). For attributes, this includes mnemonic names and attribute values. Entering a "3" will generate a list of times, vertical levels and latitude/longitude limits, depending upon the dataset contents. Enter a "4" to list actual data for the variables. These are the actual values of variables for a specified time period, level, mnemonic and latitude/longitude limits. Enter a "5" to exit the program. When exiting, any print files will be spooled to the printer and the CDF will be closed.

(4) SONY is a flag indicating whether to mount one or both SONY WORM drives for use in running CDFLST. If the default "--" (null) is entered, the program will not use the SONY. If "0" is entered, drive DIATOM::LDB0 will be mounted. If "1" is entered, drive DIATOM::LDB1 will be mounted. If "2" is entered, both drives DIATOM::LDB0 and DIATOM::LDB1 will be

mounted. Any SONY drive mounted will be dismounted automatically when the program terminates.

**DYNAMIC PARAMETERS:**
The parameters above will be looped back to until the user has finished retrieving the desired information. Depending on the input for the parameters above, one may also be prompted for other information. The new parameters which may be requested are:

(1) DATE (when CHOICE=4) is the date/time to be processed for the specified data set. Two entries are required: the first part = YYMMDDHH format, and the second part = milliseconds within the hour.
(2) FILENAME is the name of the output file which will be generated when DEST includes an "F".
(3) LAT (when CHOICE=4) defines the southern and northern latitude limits for the data to be listed. A valid range is within -90 to 90.
(4) LON (when CHOICE=4) defines the western and eastern longitude limits for the data to be listed. A valid range is within -180 to 180.
(5) LEVEL (when CHOICE=4) is the CDF level value of type LEVTYP and must be entered if a LEVTYP other than "NONE" is indicated. The units correspond to the LEVTYP, and will typically be in meters (for depth or height) or millibars (for atmospheric pressure)
(6) LEVTYP (when CHOICE=3 or 4) is the CDF level type mnemonic and must be specified if applicable. One should enter "NONE" when there is no level information in the CDF (i.e. only data at one level). When multi-level data is present in the dataset, specifying LEVTYP="NONE" will extract only the first level (i.e. whatever level is in the first element of the level array).
(7) PARAM (when CHOICE=4) is the mnemonic of the CDF variable to list.
(8) SPACING (when CHOICE=4) is the sampling frequency for latitude/longitude data. One should enter a "1" for no filtering, a "2" for plotting every second point, a "3" for plotting every third point, etc. Enter the latitude spacing followed by the longitude spacing.

**IIS BUTTON DEFINITIONS:**
The IIS is not required by this program.

**PROGRAM NAME:** CDFNODCMX
**DATE:** 4/15/91
**MENU:** CDFIN

**DESCRIPTION:** CDFNODCMX converts mixed layer and thermocline analysis products from NODC into a CDF. The data is assumed to be gridded and to have been ingested onto magnetic disk from tape using TPTODK. The particular data set obtained from NODC and supported by SEAPAK is the monthly climatology (January - December) of all data from 1978 through 1986. The data is in a one degree grid. The attributes of any CDF can be obtained using CDFLST and data can be accessed and manipulated by any of the ENVIROLIST and ENVIROANAL programs which handle CDF's. The criteria used in the analyses are the following:

Mixed-Layer Depth = 0.1 $^{\circ}$C/10m,

and Thermocline Depth = 0.3 $^{\circ}$C/10m.

These are the standard NODC criteria. The data also includes the following statistics: mean depth, maximum value, minimum value, number of observations and standard deviation.

**PARAMETERS:**
(1) INFILE identifies the ASCII data file ingested with TPTODK and is the file to be converted to a CDF.
(2) OUTFILE is the filename of the CDF. Do not include a file name extension (.EXT) because SEAPAK automatically assigns the extension.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** CDFSFMET
**DATE:** 4/15/91
**MENU:** CDFIN

**DESCRIPTION:** This program will create a Common Data Format (CDF) group of files from a tape with Jacques Servain's FOCAL dataset containing wind stress components and sea surface temperatures. The tape contains 66 files with these data, 22 for each parameter. Each of the first 21 of each group of 22 files contains monthly mean grids for a particular year from 1964 to 1984. The 22nd file of each group contains the mean, by month, over all years from 1964-1984. Within each file data records are ordered from north to south, with data west to east within each record. Data are for two degree bins from 30N to 20S and 60W to 16E. The mnemonic names in the CDF to be created are USTRESS, VSTRESS and SST for the zonal and meridional stress components and sea surface temperature, respectively.

**PARAMETERS:**
(1) TAPE is a three-part input indicating which OCF tape drive contains the FOCAL-2 tape to be processed, and which files on the tape are to be processed. TAPE(1) is the designator for tape drive. A value of '0' should be entered when the tape is mounted on MFA0:, and values of '1', '2', '3' and '4' for MFA1:, MSA0:, MTA0: and MTB0: respectively. TAPE(2) is the start file number for the processing. TAPE(3) is the number of files to be read, starting at TAPE(2).
(2) OUTFILE is the filename for the output CDF to contain the Servain FOCAL stress and sea surface temperature data (filetype excluded).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this proc.

**PROGRAM NAME:** CLR
**DATE:** 4/15/91
**MENU:** INITIAL

**DESCRIPTION:** The proc CLR clears (or blanks) user-specified image channels of the IIS. This program differs from INT in that its sole purpose is to blank specified refresh memories and not to reset the IIS to default values, i.e. the LUT's are not modified, etc.

**PARAMETERS:**

(1) CHANNEL is the number(s) of the refresh memory(ies) to be cleared. Up to 14 integers can be entered, each of which corresponds to a refresh memory, or, if all memories are to be cleared, a -1 can be entered. For example,

    CHANNEL=6 clears image channel 6
    CHANNEL=(1,5,6) clears memories 1,5, and 6
    CHANNEL=-1 clears all channels

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** CLRWAM
**DATE:** 4/15/91
**MENU:** ATMOS

**DESCRIPTION:** This program applies the clear water radiance algorithm to a CZCS level-1 scene in order to generate the atmospheric correction factors (in terms of "epsilons" and Angstrom exponents) used for the water radiance bands (1 to 3) in processing to level 2. The technique is to assume an initial guess for the Angstrom exponents, compute the level-2 normalized water-leaving radiance and pigment fields, eliminate pixels from consideration that do not meet specific criteria, assign the normalized water-leaving radiance values at 520 nm and 550 nm of the qualifying pixels to the nominal values defined by Gordon and Clark (1981) and compute the epsilons and Angstrom exponents for those pixels.

CLRWAT determines "clear water" pixels by using a set of criteria, each of which is applied to pixels not excluded by previous criteria. (This is a modification of the epsilon search techniques of Williams et al., 1985.) The criteria and the sequence in which they are applied are as follows (ranges are inclusive):

1. Exclude land, cloud, or haze pixels: pixels whose band 5 values are greater than LANCLD (land and cloud threshold) or whose band 4 values are 255 (avoids pixels with saturated 670 nm radiances). (LANCLD is an input parameter.)
2. Exclude pixels of high sun or scanner zenith angles: pixels at which the sun zenith is greater than SUN or scanner zenith angle is greater than SCAN. (SUN and SCAN are input parameters.) This criterion is used to avoid pixels with large atmospheric path radiances which may not be accurately corrected.
3. Exclude aerosol pixels: pixels for which aerosol radiance (La(670)) values are not within the input parameter AEROL4 range. Pixels with large aerosol radiances may not be accurately corrected and pixels with low values may not contain sufficient aerosol radiance to distinguish the estimate from sensor noise.
4. Exclude pixels whose normalized band 2 or 3 water radiance (calculated using the ANGEXP input values) falls outside the NLW520 and NLW550 ranges (input parameters), respectively.
5. Exclude pixels whose pigment concentrations are greater than the input parameter PTHRES.
6. Exclude pixels for which the band 2 or 3 epsilons fall outside the EPS520 and EPS550 ranges (input parameters), respectively.
7. Exclude pixels whose epsilon values are not either monotonically increasing or decreasing. The wavelength dependence on aerosol scattering should be uniformly increasing or decreasing with wavelength.

The algorithm (Gordon et al., 1983) for calculating the pigment concentrations for criterion 5 uses two-channel equations:

```
1. if Lw(550)=<0, then P=40.84719 (saturated); else,
2. if Lw(443)>0.15,
      then   P = A2 * (Lw(443)/Lw(550))**B2,          (A)
      where log10(A2)=0.053 and B2=-1.71;
      if P>=1.5 and Lw(520)>0
         then   P = A4 * (Lw(520)/Lw(550))**B4,       (B)
         where log10(A4)=0.522 and B4=-2.44;
         if P<1.5, then use (A) above;
3. if Lw(443)=<0.15 and Lw(520)>0, then use (B) above;
4. if Lw(443)=<0.15 and Lw(520)=<0,
      then P=40.84719 (saturated);
```

where Lw represents the water-leaving radiance for the band of the specified wavelength (nm) and P is the pigment concentration in mg/m$^3$.

The state of polarization of the light is taken into account in the calculations of the multiple Rayleigh scattering (exact radiative transfer theory; Gordon et al., 1988).

In "box" (interactive) mode (BOX="YES"), information regarding the epsilons for clear-water pixels are displayed on the terminal. The clear-water pixels are those found within a square cursor area (the "box"). A button function menu is provided for changing input parameters.

In non-"box" (automated) mode (BOX="NO"), the displayed information is also written to a file. Other information and image files are also generated in this mode. See the help text of BOX for more information.

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

When BOX="NO" (automated mode), the INFILE name is used to formulate the names of three output files having the extensions L2P, CLR, and SCR. One character prior to the INFILE extension (if any) is removed when creating these names. For example, if INFILE="SCENE3", then files of the following names will be created:

```
SCRATCH:[acctname]SCENE.L2P
SCRATCH:[acctname]SCENE.CLR
SCRATCH:[acctname]SCENE.SCR
```

See the help text of BOX for more information about the contents of these files.

(2) BOX: This proc can function in two modes: interactive ("box") and automated. In box mode (BOX="YES"), information regarding the epsilons for clear-water pixels are displayed on the terminal. The clear-water pixels are those found within a square cursor area (the "box"). A button function menu is provided for changing input parameters. Obviously, the IIS display must be allocated (proc ALLOC) for this mode.

In automated mode (BOX="NO"), the entire INFILE scene is processed and the displayed epsilon information is also written to a file (with a file name extension of CLR). In addition, the input parameter values and other summary information are written to another file (extension L2P) for future reference. Finally, an image file (extension SCR) is also created for subsequent use with the proc SCREEN. When SCREEN displays this image, it applies to the pixels a color code corresponding to the categories of pixels determined according to the algorithm described in the main help text above. (See the SCREEN help for the actual color code.) (See the help text of parameter INFILE for more information on the naming of these three output files.)

(3) GPLANE is the graphics plane (1-7) that will be used to mark the box using the button pad. GPLANE is used only when BOX="YES" (interactive mode).

(4) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(5) OZONE is the ozone optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the scene's center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. The actual values used will be listed in the L2P log file (if BOX="NO"). These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(6) CORR is the index of the correction method to use for calculating total radiances:
1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
2: Use correction factors specified by FACTOR.

(7) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(8) LANCLD is the land/cloud threshold to identify land and cloud pixels in exclusion criterion 1. The use of this criterion in

the program's algorithm is described in the main help text above.

(9) SUN is the solar zenith angle threshold used to avoid pixels with large atmospheric path radiances in exclusion criterion 2. The use of this criterion in the program's algorithm is described in the main help text above.

(10) SCAN is the scanner zenith angle threshold used to avoid pixels with large atmospheric path radiances in exclusion criterion 2. The use of this criterion in the program's algorithm is described in the main help text above.

(11) AEROL4 is the range for valid values of aerosol radiances (La(670)) used for exclusion criterion 3. The use of this criterion in the program's algorithm is described in the main help text above.

(12) NLW520 is the range for valid values of normalized band 2 (520nm) water radiances used for exclusion criterion 4. The use of this criterion in the program's algorithm is described in the main help text above.

(13) NLW550 is the range for valid values of normalized band 3 (550nm) water radiances used for exclusion criterion 4. The use of this criterion in the program's algorithm is described in the main help text above.

(14) PTHRES is the maximum clear-water valid pigment concentration (mg/m3) used for exclusion criterion 5. The use of this criterion in the program's algorithm is described in the main help text above.

(15) EPS520 is the range for valid values of band 2 (520nm) epsilon values used for exclusion criterion 6. The use of this criterion in the program's algorithm is described in the main help text above.

(16) EPS550 is the range for valid values of band 3 (530nm) epsilon values used for exclusion criterion 6. The use of this criterion in the program's algorithm is described in the main help text above.

(17) ANGEXP are the angstrom exponents for bands 1 to 4, respectively, for use in calculating the normalized water radiances and the pigment. These radiances and pigment are used in applying exclusion criteria 4 and 5. (See main help text above.)

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Mark Box | | | | Exit |
| 2 | | | | | Define |
| 1 | | | | | Change Box Size |

A3: Marks the box at the current position onto the GPLANE graphics plane.

F1: Used to change the box size. The box size follows a predetermined sequence of enlargements up to a maximum size. Further operations with the button reverse the sequence with successively smaller boxes.

F2: Calculates the Angstrom exponents for the current box.

F3: Exits CLRWAM.

**PROGRAM NAME:** CNVGRD
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program converts gridded ASCII data files from outside users to the SEAPAK environmental data ASCII file format. In this way, the outputs are compatible with programs ENVIMG for producing gray level images from the data, or GEMPLOT for producing contours from the data, or ASCFUNC for finding the data extremes over a group of files. Up to 50 files can be converted in a single run of the program. A land masking value can be specified if desired.

**PARAMETERS:**

(1) INFIL are the gridded input data ASCII files. Up to 50 values may be specified. These must be ASCII files in one of the formats described in parameter TYPE, and should be fully qualified VMS filenames.

(2) OUTFIL are the output (SEAPAK format) gridded ASCII file names. Up to 50 names may be specified, corresponding to the values of INFIL.

(3) TYPE is the conversion type. Type 1 is for Geophysical Fluid Dynamics Lab model output of gray levels for the N. Atlantic (100W-20E, 30S-70N at 2x2 degree resolution; a 51x62 point dataset) representing seasonal, annual and monthly mean pigment. Type 2 uses output from a Mac II spreadsheet containing a grid of time vs. latitude data created from multiple runs of program ZONE. Up to 50 values may be specified, corresponding to the values of INFIL and OUTFIL.

(4) START is the start date of the input data. Enter in form YYMMDDHH, i.e. 79021215 signifies Feb. 12, 1979 at 1500. This is simply for informational purposes in the output file. Up to 50 files may be specified, corresponding to the values of INFIL and OUTFIL.

(5) END is the ending date of the input data corresponding with START.

(6) LANDVAL is the data value from INFIL representing land. The output ASCII file will contain a land flag for any data values with values equal to LANDVAL. This parameter applies to all TYPE=1 conversions, and is nullable.

(7) PARAM is the parameter description for the input file, used for TYPE=2 conversions only. This is used for informational purposes only in the output file. Up to 50 values may be specified.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** COAST
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc generates a coastline overlay for SEAPAK images using the CIA World Data Base. After the graphics plane for the coastline is selected and "RUN" is typed, the proc prompts the user for the image for which to generate a coastline and on which IIS channel to display this image. During program execution, new images can be dropped, the refresh memory can be changed, the standard SEAPAK annotation package can be called, and graphics planes can be changed, turned on/off or erased, and saved to disk or restored from disk. It should be noted that the coastline is generated over the entire screen even though the image may only take up a portion of the screen.

**PARAMETERS:**

(1) PLANE defines the graphics plane to use for the coastline. This can be later changed using the IIS button menu.

(2) LON_RNGE is the longitudinal limits of the image in degrees. The western limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used.

(3) LAT_RNGE is the latitudinal limits of the image in degrees. The northern limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used.

**DYNAMIC PARAMETERS:**

After the previous parameter has been selected and "RUN" entered, the user is prompted for more parameters. These define the image file to use and on which IIS channel to display the image. These parameters are those associated with the proc IMAGE and are defined there.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | | F |
|---|---|---|---|---|---|---|
| 3 | Drop New Scene | Change Refresh Memory | SEAPAK Annotation | Save/ Restore Graphic Plane | | Exit |
| 2 | | | | | | |
| 1 | Change Plane | | On/Off/ Erase Graphics Plane | Draw Coastline | | |

A1: Depressing this button allows the user to change the input parameter PLANE.

A3: This button enables the user to drop a new image. The proc IMAGE is called. See that proc description for a list of parameters requested.

B3: A new refresh memory can be selected using this button. The proc SELECT is executed to perform this task. See that program for a description of the parameters requested.

C1: Selected graphics planes can be toggled on/off or erased by this button. The user is prompted with the parameters PLANES and ONOFF. PLANES is a list of up to 7 graphics planes to be turned on,off or erased. ONOFF specifies the action to be performed for each plane. A "0" turns the plane off (disables it); a "1" turns it on (enables it); a "2" erases the plane (clears it).

C3: This button executes the ANNOTATE proc which in turn enables one to annotate the image. This proc is described elsewhere. To return to COAST depress the EXIT button, F3, on the ANNOTATE button menu.

D1: This button initiates the actual drawing of the coastline. Before the coastline is drawn, however, the user is prompted for two parameters. The first is INDEX which corresponds to the coastline indices of the CIA WDB-II data base. The coastlines will then be displayed according to the user's specifications. One or more of the following indices are to be specified:

<u>WDB-II coastline index(es)</u>
1 major coast/islands/lakes
2 additional major islands/lakes
3 intermediate islands/lakes

4 minor islands/lakes
6 intermittent major lakes
7 intermittent minor lakes
8 reefs
9 major salt pans
10 minor salt pans
13 major ice shelves
14 minor ice shelves
15 glaciers

The second parameter that one is prompted with is SSRATE. SSRATE is the subsampling rate for the corresponding INDEX. An SSRATE value of n indicates that only every nth database value will be used. For most applications, the maximum (default) value should be adequate and will greatly reduce the amount of time required for the proc to run.

D3: One can save or restore the graphics planes using this button. The proc BPSAV is executed when the button is depressed. This program is descibed elsewhere.

F3: This button terminates the proc.

**PROGRAM NAME:** COLBAR
**DATE:** 4/15/91
**MENU:** COLOR

**DESCRIPTION:** COLBAR is a proc which displays a color bar on a specified refresh memory of the imaging system. The direction (horizontal or vertical), screen location, size and number of blocks of the color bar are all selected by the user.

**PARAMETERS:**
(1) CHAN indicates into which refresh memory the color bar will be loaded.
(2) BLOCKS is the total number of color blocks associated with the color bar to be loaded. The range on this parameter is [2,40]. If the color bar that is loaded has more blocks than is specified by this parameter, only the specified number will be loaded.
(3) SS specifies the starting sample, i.e. beginning pixel, for the color bar.
(4) SL specifies the starting line for the color bar.
(5) NS indicates the total number of samples, or pixels, in the color bar.
(6) NL indicates the total number of lines in the color bar.
(7) BORDER: Enter 0 to indicate no border around the color bar; 1 to 7 to specify the graphics plane for the border; 11 to 77 for a two-line thick border in the graphics plane indicated by the first digit.
(8) DIR defines whether the color bar will be horizontal or vertical. DIR = 0 for horizontal and 1 for vertical.
(9) GPLANE is the number of the graphics plane that can be used by this proc for labeling the color blocks.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Block Color | Change # of Color Blocks | Load PAINT File | Blocks I.D. On\Off | Exit |
| 2 | | | | | |
| 1 | | | | Draw Tick Marks | |

A3: Used to change a blocks color.
B3: Used to change the number of color blocks.
C3: Loads a color file generated under PAINT.
D1: Draws tick marks for the color bar.

1) SP is the starting pixel of the tick mark base line.
2) SL is the starting line of the tick mark base line
3) NP is the number of pixels for the length of a horizontal tick mark base line. See NL.
4) NL is the number of lines for the length of a vertical tick mark base line. If NP=0 and NL>1, a vertical base line is drawn; if NP>1 and NL=0, a horizontal line is drawn. If NP>1 and NL>1, a diagonal base line with no tick marks is drawn.
5) HTICK: Enter 0 for no tick marks (base line only); >0 for tick marks drawn toward the right or upward; <0 for tick marks drawn toward the left or downward.
6) GPLANE specifies the graphics plane (1 to 7) to use.

D3: Toggles the color block I.D. numbers on or off.
F3: Exits COLBAR and returns the user to SEAPAK.

**PROGRAM NAME:** COMPRESS
**DATE:** 4/15/91
**MENU:** GENUTIL

**DESCRIPTION:** This proc provides for the compression/uncompression of sequential files under VMS, and is based on the COMPRESS program from USENET. Compressed files are binary data. This means that the contents are not directly readable and must not be printed to the system printer. However, one may view the contents of a compressed file with this proc without creating the decompressed file by setting the parameters OUTPUT="TT:" and MODE="U". This will send the information to the screen, just as TYPE does for ordinary files. This proc creates a compressed/uncompressed file for each file named in the parameter list. The compressed files require less disk space than the original files which can then be deleted. When the data in the original files is needed, the original files can be re-created using the UNCOMPRESS (MODE="U") option. The compress algorithm preserves RMS file format information, so that when a file is decompressed it will have the same format as the original file. Only sequential files can be compressed; indexed or relative files (such as NOTES$NOTEBOOK.NOTE or MAIL.MAI) cannot be compressed. Compressing a file which is already compressed usually WASTES space. This is indicated by a negative compression percentage.

Examples:

1) These inputs compress all FORTRAN files in the current directory and stores the compressed files in a subdirectory called ARCHIVE.DIR .

```
MODE = "C"
FILES = "*.FOR"
OUTPUT= "[.ARCHIVE]"
```

2) These inputs decompress a file called PHONELIST.TXTZ and prints the contents on the terminal:

```
MODE = "U"
FILES = "PHONELIST.TXTZ"
OUTPUT = "TT:"
```

**PARAMETERS:**

(1) MODE is a flag indicating whether the operating mode is to compress the named file(s) (MODE = "C"), or to uncompress, i.e. decompress, the named file(s) and re-create the original version(s) (MODE = "U").

(2) FILES is the name(s) of the file(s) to be compressed/uncompressed. Several file names can be given. Each must be separated by commas or implied with a wildcard (*). For each named file, compressed/uncompressed file with

the same name will be created, but with "_Z" appended to/removed from the file type. For example, if you have two files called REPORT.RNO and REFERENCES.TXT, entering a value: "REPORT.RNO, REFERENCES.TXT" for the FILES parameter will create two files called REPORT.RNO_Z and REFERENCES.TXT_Z if MODE = "C".

(3) OUTPUT is the name(s) of the output file(s) and is an optional parameter. By default, an output file with a name based on the name of the input file will be created. Another name can be used by entering a value for OUTPUT. If the FILESPEC is a directory path, all output files will have default names, but they will be placed in the specified directory.
Use OUTPUT="TT:" to have the output sent to the terminal. NOTE: This should only be used in conjunction with MODE="U" and is useful since compressed files contain binary information which will not print nicely on a terminal screen (just like .EXE or .OBJ files).

(4) DELETE is a flag indicating whether or not the original file(s) are to be deleted. Entering a "Y" will lead to the deletion of each input file after creating the corresponding compressed or uncompressed output file. An "N" will not delete the original.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** CONTOUR
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc enables the user to contour an image at specified gray levels. The gray levels can be specified by an input value or the value corresponding to the current cursor location. Gray level mask values, those values not to be included in the contouring, can also be defined. Blotching can be performed on the image in two ways: 1) using the standard vertex oriented blotch, or 2) blotching between specified contours. When a blotch has been defined, one can decide whether to contour only within a blotch or everything outside a blotch. Other options allow the user to drop a new scene, change refresh memory, change default graphics plane, or annotate.

**PARAMETERS:**

(1) PLANE is the starting (default) graphics plane. A value of 1 to 7 should be entered. This plane can be changed interactively with the IIS button menu.

(2) BLANK is the parameter which indicates whether one wants to blank the starting PLANE before running the program. The input is a "Yes" or "No".

(3) MASKVALS specifies the gray level values for masking, i.e. those values which are to be ignored when forming a contour. The contouring algorithm looks at adjacent pixel values when forming a contour. If it is undesirable to contour in the vicinity of certain values, maskvals allows the user to avoid these values. This is often helpful in obtaining clean contours when the image is noisy at the contour value. The acceptable values to be entered are 0 to 255, or -1 for none. Up to five values can be specified.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Drop New Scene | Change Refresh Memory | Change Graphics Plane | Save/Drop Graphics Plane | Exit |
| 2 | ANNOTATE | Read Cursor Value | Contour Cursor Value | Run READ | Toggle Blotch/ Image Contouring |
| 1 | On/Off/ Erase Graphics Plane(s) | Erase Cursor Contour Value | Add Or Erase Contours, Change mask | Set Up Blotch | List Contours |

A1: This button allows enabling (on), disabling (off) or clearing (erasing) single or multiple graphics planes. The user is prompted for two parameters, PLANES and ONOFF. PLANES is a list of up to 7 graphics planes to be turned on, off or erased. ONOFF specifies the action to be performed for each plane, i.e. turn it on (enter a "0"), turn it off (enter a "1") or erase it (enter a "2"). Note that the same number of values for PLANES and ONOFF must be entered.

A2: This button calls the proc ANNOTATE. The prompts and button menu of that proc are described elsewhere in this manual. Exiting ANNOTATE returns the user to the CONTOUR button menu.

A3: Depressing this button allows one to drop a new image by essentially calling the proc IMAGE. In addition to the normal prompts from IMAGE, the values for the parameter MASKVALS are also requested.

B1: The contour associated with the current cursor value can be erased by depressing this button.

B2: This button causes the gray scale value of the current cursor location to be read. The pixel/line coordinates of the cursor are also output.

B3: This button allows the user to change IIS refresh memories by calling the proc SELECT. One is prompted to input the new channel number.

C1: This button enables the user to add more contours and/or erase existing ones, or change the gray level masking values (MASKVALS). The contours that are added can be assigned to various graphics planes. The first prompt one gets after the button is depressed is to specify the MODE to be used. The MODE indicates whether one is going to add contours, erase contours or both add and erase contours:

MODE = 1 for adding only,
2 for erasing only,
3 for both adding and erasing.

When MODE=1, the user is prompted with the additional parameters:

1. ADDBRKS specifies gray level values for contouring. From 1 to 20 values in the range 0 to 255 may be input.
2. ADDPLNS defines the graphics planes for each of the corresponding contours specified in ADDBRKS (a plane must be specified for each gray level). There are seven graphics planes to choose from, hence the inputs are numbers between 1 and 7. Recall that the colors can be redefined using BPCOLOR. The standard color scheme is:

Plane 1: pink
2: red
3: green
4: yellow
5: orange
6: cyan
7: sand

When MODE=2, the user is prompted with the parameters:

1. RMVBRKS specifies gray level values for the contours to be erased. From 1 to 20 values in the range 0 to 255 may be input.
2. RMVPLNS defines the graphics planes for each of the corresponding contours specified in RMVBRKS (again a plane must be specified for each break or gray level). There are seven graphics planes to choose from, hence the inputs are numbers between 1 and 7.

When MODE=3, the user is prompted with all four of the parameters defined above, i.e. ADDBRKS, ADDPLNS, RMVBRKS and RMVPLNS.

C2: A contour will be drawn in the current graphics plane for the gray level corresponding to the present cursor location by depressing this button.

C3: This button enables the user to change the current graphics plane to another one. One is prompted for the number of the new plane, so enter a value for PLANE between the values 1 and 7.

D1: This button enables the user to create a blotch in one of two different ways: 1) by defining the vertices of a polygon (the standard BLOTCH program), or 2) by specifying two contours between which the blotch will be created. The graphics plane to receive the blotch is also specified. Three parameters are requested:

1. BLPLN is the blotch plane number. A value of 1 to 7 needs to be entered.
2. MODE indicates the blotching mode. A 1 is entered for a standard blotch using a polygon defined by vertices (see the documentation associated with BLOTCH for the details concerning the button menu) and a 2 for a blotch between contours. NOTE: This MODE is different from the MODE associated with button C1.
3. CONTS is the gray level values of the contours between which the filling will be done. Two contours must be specified.

D2: This button allows the user to read the gray level or scientific units on the image by calling the proc READ. The normal button menu for that proc will then be dropped. To exit READ and return to the CONTOUR button menu, depress the exit button of READ, F3.

D3: This button allows the user to save or drop graphics planes by calling the proc BPSAV. The normal button menu for that proc will then be dropped. To exit BPSAV and return to the CONTOUR button menu, depress the exit button of BPSAV, F3.

F1: This button enables the user to list the contours generated and the graphics planes where they are drawn.

F2: One can choose to contour the entire image or only an area defined by a blotch by toggling this button. The parameter CNTLOC specifies the location for contouring. To contour everything on the image but the blotch (i.e. outside the blotch) one must enter a 0 for CNTLOC. To contour inside the blotch only, a 1 must be entered.

F3: Depressing this button exits the proc.

**PROGRAM NAME:** CONTROL
**DATE:** 4/15/91
**MENU:** HEADER

**DESCRIPTION:** Associated with every image is a control point file. This file contains all the information SEAPAK needs to determine the latitude/longitude of any pixel. This file is generated automatically when the Level 1 data are ingested. The name of this file is stored in the header of each image. The purpose of CONTROL is to be able to edit this image header file in order to change the name of the control point file. This can become necessary since the filename of the control point file contains its device location. If the location of the file has changed for some reason, e.g. the data was reloaded on a different disk, then SEAPAK can no longer find the file at the original location. This is where this program becomes vital since it allows one to change the control point file name. The current location of the control point files for a set of images, i.e. all the bands for a scene, can be updated with one execution of this program.

**PARAMETERS:**

(1) INFILE is a parameter with a maximum array size of six. This parameter must correspond to 512x513 image files or full size images generated using TP2DSK. The header of these images will be modified such that the control point file name is replaced by CTLFIL.

(2) CTLFIL is the new name of the control point file that will be entered into the header of the image files specified by INFILE.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** CORCO
**DATE:** 4/15/91
**MENU:** STAT

DESCRIPTION: This proc calculates the correlation coefficient and other statistics for two images currently residing in IIS refresh memories (CHN1 and CHN2). The pixels used in this analysis are those within the blotch area of the current graphics plane and whose values are within specified ranges (RANGE1 and RANGE2). When A1 of the IIS button pad is pressed, the following statistics are calculated: the correlation coefficient between the images and the number of pixel pairs used; the mean values and standard deviations for each image; and the coefficients of skewness and of excess (kurtosis) for each image. Button B1 may be used to display the scatterplot for the same blotch area and ranges.

Button functions are also provided to draw or modify the blotch area for the current graphics plane, to change the current graphics plane by cycling through planes 1 to 7 and to change the range for the analyses and plots. You may use different graphics planes (up to 7) to save different blotch areas for which you would like to calculate the correlation coefficients.

**PARAMETERS:**

(1) CHN1 is the channel number for one of the two input images. An integer between 1 and 14 should be entered. If a scatter-plot will be requested (button B1), the X axis of the scattergram will be used for the image in CHN1 and the Y axis for the CHN2 image. Note that CHN1 and CHN2 cannot have the same value and cannot be channel pairs (e.g., 1 and 8, 2 and 9, etc.).

(2) CHN2 is the channel number of the second image and will be the Y axis of the scattergram. Again, an integer between 1 and 14 should be entered with the qualification as mentioned above, i.e. CHN1 and CHN2 cannot have the same value or be channel pairs.

(3) MODE1 defines whether the image in CHN1 is scaled linearly or is in pigment concentration. A value of "1" (the default value) should be entered if the pixel values of the CHN1 image represent data (such as temperature) that are linearly related to gray levels. A value of "2" should be entered if they represent pigment concentrations (mg/m3).

(4) MODE2 is similar to MODE1 except that it defines whether the image in CHN2 is scaled linearly or is in pigment concen-tration.

(5) FACT1 is a non-negative scaling factor which is used only if MODE1=1, i.e. the data-to-gray scale mapping function is linear for the CHN1 image. It is ignored when MODE1=2. If FACT1 is positive, it will represent the factor by which to divide the gray values of CHN1 pixels in order to convert them into actual data values. If zero is entered, the slope and intercept for this mapping function will be obtained from the

header of the disk file for the CHN1 image. In order to retain the gray values, a "1" (the default value) should be entered; for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170. Note that the use of different linear mapping functions does not affect statistics that are not unit dependent (such as the correlation coefficient) and will not alter the appearance of a scatterplot other than ensuring that the values labelling the axes reflect those of the image data

(6) FACT2 is the linear, data-to-gray scale mapping function for CHN2. Similar comments apply here as for FACT1.

(7) RANGE1 defines the range of CHN1 pixel values to use for the calculation of the statistics and scatterplots. Two values should be entered for this parameter These values should conform to the units of the CHN1 image (i.e. pigment concentration or units linearly proportional to gray levels) as specified by MODE1 and FACT1. Pixel values less than the smaller RANGE1 value and those greater than the larger RANGE1 value will be excluded from the analysis and plots (thus pixels rejected by this criterion will also eliminate the corresponding CHN2 pixel from consideration). For example, to exclude land and cloud pixels for a level 2 CZCS image, the RANGE1 values should be 1.0 and 254.0 (the default values) for gray levels (MODE1=1 and FACT1=1) or 0.0425 and 39.0 for pigment concentrations (MODE1=2). These range values can be modified interactively with IIS button D1 later.

(8) RANGE2 defines the range for CHN2 values in data units. The comments above for RANGE1 are also applicable here except now they apply to CHN2 and hence the Y axis.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick New Vertex | Remove Last Vertex | Blotch Interior Of Region | On/Off Plane | Exit |
| 2 | Go To Next Plane | Blank Current Plane | Blotch Exterior Of Region | Erase Blotch | |
| 1 | Compute Correlation | Display Scatterplot | Switch Or Turn On Image | Modify Ranges | |

A1: Depressing this button results in the calculation of several statistical products. These are: the correlation coefficient between the images and the number of pixel pairs used; the mean values and standard deviations for each image; and the coefficients of skewness and of excess (kurtosis) for each image.

A2: This button allows the user to select a new graphics plane in which to define a blotch polygon. The plane is automatically incremented when this button is depressed and the new plane number is displayed on the terminal.

A3: This button allows one to select a new vertex for a blotch being defined. After the first vertex has been selected, it also causes a line to be drawn connecting the previous vertex to the presently selected one.

B1: To display the scatterplot, this button must be depressed. The parameter SCAT_PL will then be requested. This parameter defines the graphics plane to use for the scatterplot. A number between 1 and 7 that is not the same as that of the current blotch plane should be entered.

B2: The current graphics plane can be totally erased with this button. Note that when this button is used in conjunction with A2, you are allowed to erase any plane.

B3: This button will delete the last vertex created using A3.

C1: This button allows the user to switch the display between the two images defined by CHN1 and CHN2, or switch the image back on after the scatterplot has been generated.

C2: Depressing this button causes the region exterior to the defined polygon to be filled after the polygon has first been closed by connecting the first and last vertices.

C3: Pushing this button causes the interior of the defined polygon to be filled after the polygon is first closed by connecting the first vertex with the last.

D1: The input parameters RANGE1 and RANGE2 can be changed using this button.

D2: This button allows the user to turn the current graphics plane off (or on) to view the area under the blotch. This does not erase the plane as does B2.

D3: This button allows one to erase the current blotch. The lines that were used to determine the blotch are unaffected, i.e. only the part that has been filled in is erased. Use button B2 to erase the entire blotch plane.

F3: This button terminates the proc.

**PROGRAM NAME:** CURBOX
**DATE:** 4/15/91
**MENU:** CURSOR

**DESCRIPTION:** This program displays a roamable box or rectangle on the IIS monitor. The size of the box is controlled by the user. The pixel/line location of the box can be read by using the IIS button D3. The option also exists to mark the current location of the box in a graphics plane the user chooses. This program is especially useful when trying to locate an area of interest for input to other programs.

**PARAMETERS:**
(1) SIZE specifies both the width and length of the box. The width is in pixels and the length is in lines.
(2) GPLANE defines the graphics plane in which to display the box.
(3) MARK is the graphics plane on which to mark the location of the box.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Box Size | | | Show Box Coordinates | Exit |
| 2 | | | | | |
| 1 | | | Change Plane To Mark Box | Mark Box | |

A3: This button is used to modify the box size. The parameter SIZE is requested when the button is depressed.
C1: The graphics plane (MARK) on which to save the current box location can be changed when this button is depressed.
D3: The box coordinates are displayed to the terminal when this button is depressed. The output consists of the upper left and lower right pixel and line values.
D1: The current location of the box is marked on the graphics plane defined by MARK when this button is depressed.
F3: This button exits the program.

**PROGRAM NAME:** CURMET
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program will copy the ASCII current meter mooring data files from a data tape provided by Dr. T. N. Lee at the University of Miami onto disk. The program assumes that a tape listing is provided with the tape in order to determine the number of files on the tape.

**PARAMETERS:**

(1) TAPE is the tape drive specification (e.g. MFA0 on the OCEAN1 node of the Laboratory for Hydrospheric Processes' local area Vax cluster).

(2) NFILES is the number of files to dump from tape. At present, the files are copied to the SCRATCH:[JIMF] with file names of SERx.CUR where "x" is a sequential number.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** CURMOD
**DATE:** 4/15/91
**MENU:** LUT

**DESCRIPTION:** CURMOD initiates an interactive task that modifies look-up table mappings via cursor movement as opposed to keyed input as in LUTMOD. The program modifies look-up table mappings by level slicing corresponding to the slope of the line extending from the cursor to near the bottom left of the display at (0,511). As the cursor is moved in such a way as to increase the slope, the level slice is compressed or increased, and as the cursor is moved so that the slope is decreased, the level slice is expanded or decreased. A range may be specified limiting the slicing to all the values between the input starting and ending pixel values, otherwise these have respective defaults of 0 and 255 which modifies all pixels. Note also that the output gray levels always map from 0 to some number less than or equal to 255, i.e. you cannot map the input into a gray level range of (50,100) but you could map to a range of (0,100).

**PARAMETERS:**

(1) CHANNEL designates the refresh memory whose look-up table is to be modified. The CHANNEL parameter accepts one of the following values:

1 - CHANNEL 1
2 - CHANNEL 2
.
.
.
14 - CHANNEL 14

(2) STARTPIX is the beginning of the input range whose output gray level is to be modified. This parameter accepts any value from 0 to 255. The default value is zero.

(3) ENDPIX is the end of the input range whose output gray level is to be modified. This parameter accepts any value which is within 0 to 255 and is greater than or equal to STARTPIX. The default value is 255.

(4) COLOR specifies the LUT(s) to be modified. The COLOR parameter accepts up to three values. The following are examples of acceptable input:

COLOR=(RED,GREEN,BLUE) means that the red, green and blue look-up tables will be modified (these are the default values)

COLOR=GREEN means that the green LUT will be modified.

COLOR=(BLUE) means that the blue and red LUT's will be modified.

Note that the right-hand characters of the color names can be truncated.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Graph Pixel Gray Level Mapping | Erase Plotted Graph | Obtain Table of Pixel/Gray Level Mapping | | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button allows one to make a plot of the pixel/gray level map.
B3: The graph generated using A3 can be erased with this button.
C3: The pixel/gray level map can be listed on the user's terminal with this button.
F3: This button terminates CURMOD and returns the user to SEAPAK.

**PROGRAM NAME:** CUROFF
**DATE:** 4/15/91
**MENU:** CURSOR

**DESCRIPTION:** The purpose of CUROFF is to disable the display of the cursor. There are occasions when it is not desirable to have the cursor displayed on the IIS, e.g. while taking pictures. This program allows one to be able to turn off the cursor when one wants to do so. To turn the cursor back on, it is best to use CURON. Note however, that this method will reset the cursor location to (255,255).

**PARAMETERS:**
There are no parameters. Just type RUN to execute.

**IIS BUTTON DEFINITIONS:**
There are no buttons used.

**PROGRAM NAME:** CURON
**DATE:** 4/15/91
**MENU:** CURSOR

**DESCRIPTION:** Program CURON turns on or modifies the cursor and repositions it to (255,255) on the IIS screen. The color of the cursor is specified by three numbers that correspond to the red, green and blue intensities respectively. There are also 6 cursor shapes from which one may select.

**PARAMETERS:**
(1) CURTYPE is the parameter which defines the shape of the cursor. There are 6 acceptable values for CURTYPE:

1) LARGE-CROSS (DEFAULT)
2) SMALL-CROSS
3) SOLID-BOX
4) BOX
5) X-CURSOR
6) CIRCLE

NOTE: CURTYPE may be abbreviated by truncating right-hand characters as long as uniqueness is maintained.

(2) COLOR specifies the color of the cursor. COLOR must have three values input between 0 and 31. These specify the intensities of the red, green and blue, respectively. For example:

```
COLOR = (31,31,31)   =>   WHITE
COLOR = (25,0,0)     =>   RED
COLOR = (0,25,0)     =>   GREEN
COLOR = (0,0,25)     =>   BLUE
COLOR = (0,0,0)      =>   BLACK
COLOR = (23,23,0)    =>   YELLOW
COLOR = (23,0,23)    =>   PURPLE
etc.
```

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** CURREAD
**DATE:** 4/15/91
**MENU:** CURSOR

**DESCRIPTION:** This program reads the current cursor position on an IIS Model 75. The (x,y) coordinates displayed on the terminal correspond to (pixels,lines) as measured from the upper left hand corner of the IIS display screen. The range of values is from (0,0) to (511,511).

**PARAMETERS:**
There are no parameters to enter. Simply type "RUN" to execute.

**IIS BUTTON DESCRIPTION:**
No buttons are required in this program.

**PROGRAM NAME:** CZCS
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays showing CZCS data fields processed by SEAPAK.

The examples are, in sequence:

1. Charleston gyre pigment concentrations, October 28, 1979.
2. Arabian sea pigment concentration variogram.
3. AVHRR sea surface temperatures, northwest Spain.
4. South Atlantic bight pigment difference, winter-summer, 1978-1979.
5. Maximum entropy method power spectrum for pigment concentrations off the Amazon delta.
6. Interactive pseudocoloring of a CZCS pigment concentration image.
7. Pigment concentrations across Charleston gyre, October 28, 1979.
8. Pigment concentrations histogram for western north Atlantic.
9. CZCS level 1, channel 3, orbit 3445 over Baffin Bay and Greenland.
10. CZCS level 1, channel 5, orbit 3445, full resolution over Hayes Peninsula.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Buttons are defined in the programs called.

**PROGRAM NAME:** CZCSBRF
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays showing CZCS data fields processed by SEAPAK (this is an abbreviated version of the products displayed by the program CZCS).

The examples are, in sequence:

1. Charleston gyre pigment concentrations, October 28, 1979.
2. Arabian sea pigment concentration variogram.
3. AVHRR sea surface temperatures, northwest Spain.
4. Maximum entropy method power spectrum for pigment concentrations off the Amazon delta.
5. Pigment concentrations histogram for western north Atlantic.
6. CZCS level 1, channel 3, orbit 3445 over Baffin Bay and Greenland.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** DATA
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays showing ancillary data fields processed by SEAPAK.

The examples are, in sequence:

1. Northern hemisphere Navy bathymetry (1000 and 4000m contours), polar stereographic projection.
2. Winter 1979 NOAA/Climate Analysis Center (CAC) North Atlantic mean sea surface temperature and First GARP Global Experiment (FGGE) 1000 millibar streamlines.
3. Spring 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar streamlines.
4. Summer 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar streamlines.
5. Fall 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar streamlines.
6. Mixed layer depth, North Atlantic, March mean.
7. Latent heat flux, North Atlantic December mean.
8. NODC hydrographic stations, North Atlantic, 1980-1986.
9. Ekman upwelling, North Atlantic, February 1979.
10. Time series of several fields for the week of the President's Day snowstorm, 1979.
11. Skidaway Institute of Oceanography temperature profiles along Charleston gyre, created with GEMPAK.
12. Selected FGGE drifter tracks on southern ocean bathymetry image.
13. Interactive plotting of SEQUAL/FOCAL drifter tracks on bathymetry (program DRIFTER will be run and button F3 should be pressed to exit, after two drifter tracks are drawn).

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Buttons are defined in the programs called.

**PROGRAM NAME:** DATABRF
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays showing ancillary data fields processed by SEAPAK (this is a brief version of the program DATA).

The examples are, in sequence:

1. Northern hemisphere Navy bathymetry (1000 and 4000m contours), polar stereographic projection.
2. Winter 1979 NOAA/Climate Analysis Center (CAC) North Atlantic mean sea surface temperature and First GARP Global Experiment (FGGE) 1000 millibar streamlines.
3. Latent heat flux, North Atlantic December mean.
4. NODC hydrographic stations, North Atlantic, 1980-1986.
5. Ekman upwelling, North Atlantic, February 1979.
6. Time series of several fields for the week of the President's Day snowstorm, 1979.
7. Skidaway Institute of Oceanography temperature profiles along Charleston gyre, created with GEMPAK.
8. SEQUAL/FOCAL drifter tracks on bathymetry.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** DEALLOC
**DATE:** 4/15/91
**MENU:** INITIAL

**DESCRIPTION:** DEALLOC deallocates an IIS Model 75 imaging system. This then would allow another user to be able to access the IIS for their use. This is done automatically when one logs off the system.

**PARAMETERS:**
There are no parameters. Just type RUN to execute.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** DENSPROF
**DATE:** 4/15/91
**MENU:** UNGRIDANL

**DESCRIPTION:** This program is used for computing ocean density and Brunt-Vaisala frequency from hydrographic sounding data. The sounding data must be a file created by a SEAPAK indexed file query program (or a facsimile of such a file) and must contain columns for depth (in meters), temperature (in Celsius), and salinity (in NSU). DENSPROF currently supports inputs from ASCII files created by station data (RDNODCSD, RDNCSDBA, RDNCSDBA_CD), Skidaway (RDSKDWAY, RDSKDBA), XBT (RDXBT, RDXBTBA), and Southern Ocean (RDSOADS) listing programs in SEAPAK. An algorithm proposed by Millero et al. (1980) is used to compute density at the levels provided in the hydrographic sounding dataset. The pressure term required by this algorithm is obtained by integrating the hydrostatic expression over depth for each level:

$$P = g*\rho(i-1)*(z(i-1) - z(i)),\ i=1,n$$

where g is gravity, $\rho$ is density, and z is depth at level i. The Brunt-Vaisala frequency (f) is computed at each level using:

$$f = (g/\rho)(d\rho/dz).$$

The user specifies if the output is to be written in GEMPAK4 ASCII sounding format, Golden Software, Inc.'s Surfer spreadsheet format, or both. These formats permit the data to be loaded into a GEMPAK4 binary sounding file or a Surfer spreadsheet and plotted as a vertical profile or cross section, respectively. The sounding ASCII file can be used directly or in conjunction with GEMPAK4 programs SNCFIL, SNEDIT, and SNPROF to create, load, and plot the GEMPAK4 sounding file. Blanking and boundary files may also be created for Surfer to mask data or create boundaries.

**PARAMETERS:**

(1) INFIL is the filename of an ASCII file created by one of the following programs:

RDNODCSD, RDNCSDBA, RDNCSDBA_CD (station data)
RDSKDWAY, RDSKDBA (Skidaway data)
RDXBT, RDXBTBA (XBT data)
RDSOADS (Southern Ocean Atlas data)

(2) OUTFIL is the name of the converted file to be used in either GEMPAK4 or Surfer. A fully qualified VMS filename should be specified. The GEMPAK4 data filename will appear as specified by OUTFIL. The station listing, parameter packing file, and Surfer filenames are specified by OUTFIL with "_stns", "_pck", and "_sfr" respectively appended to the filetypes.

(3) TYPE specifies the type of output file to be created. TYPE 1 is used for creating ASCII files compatible with GEMPAK4. These files can be used in conjunction with GEMPAK4 programs SNCFIL, SNEDIT and SNPROF for plotting standard individual vertical profiles. A GEMPAK4 format ASCII file station list and packing file are also created. The station listing file is required for GEMPAK4 navigation and consists of sequentially numbered soundings with latitude and longitude of each site. The latitudes and longitudes are multiplied by a factor of 100 for compatibility with GEMPAK4. The GEMPAK4 station list will have the name specified in OUTFIL with "_stns" appended to the filetype. GEMPAK4 program SNCFIL requires a parameter packing file. This file defines the minimum, maximum, and the number of places after the decimal for each parameter. TYPE=2 is used for creating a spreadsheet compatible with Golden Software Inc.'s Surfer package. This output is in tabular form with columns for distance along section, depth, parameters (temperature, salinity, density, sigma-T, Brunt-Vaisala frequency), date, and time. These data can be used to create sections of depth as a function of distance. TYPE 3 will create both of the above files.

(4) BLANK is the Surfer blanking/boundary file option. A maximum of two files can be created by DENSPROF using parameter BLANK (for TYPE 2 and 3 only). A blanking file may be used when creating a grid in the GRID module of SURFER in order to prevent values (and contours) from being generated below the bathymetry bottom depth. A second file can be used for drawing the bottom contours for the TOPO module of SURFER. This analysis can be either a crude representation (using only bottom depth values at the individual stations taken form the RD... program station list) or a more detailed representation (using five minute resolution NORDA bathymetry data along the entire section). If an option other than null is entered for BLANK when TYPE=1 it is ignored. When TYPE=2 or 3 and a value of null is entered for BLANK, no blanking or boundary file will be created. For BLANK=1 a blanking file compatible with the GRID module of SURFER is created. This file uses the filename portion of OUTFIL, appended by "_G". The filetype is ".BLN", compatible with Surfer's default. This will effectively blank out grid points falling below the station's bottom depth. For BLANK=2, the blanking file for GRID and a crude boundary file to be used with the TOPO module of SURFER are created. The boundary file is obtained from the output bottom depths query programs (RD...) and uses the filename portion of OUTFIL appended by "_T". The blanking file uses the filename portion of OUTFIL, appended by "_G". The filetype is ".BLN" for compatibility with Surfer. For BLANK=3, the blanking file for GRID is created and a detailed boundary file to be used with the TOPO module of SURFER are created. The boundary file contains full five minute (10 km) resolution NORDA bathymetry data along the entire section. The blanking file uses the filename portion of OUTFIL,

appended by "_G". The boundary file uses the filename portion of OUTFIL appended by "_T". The filetype for both is ".BLN" for compatibility with Surfer.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** DERIV
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc calculates the spatial derivatives of an input image file. One output data file (in a non-image format) is created for each derivative requested. The program works in either one of two modes depending on whether or not an IIS is available for use. If the subcommand "-DISPLAY" is used, the derivatives will be generated as output files and immediately displayed on the IIS for examination, optimization of the gray scale, and saving as image files. For the subcommand "-NODISPLAY", the data files are generated but the proc STATDIS must be subsequently used to display them.

The following derivatives may be requested:

```
DX(x,y) = (P(x,y) - P(x-1,y)) / XDIST        (1st derivative in X
                                              direction)
DY(x,y) = (P(x,y) - P(x,y-1)) / YDIST        (1st derivative in Y
                                              direction)
DXDY(x,y) = DX(x,y) + DY(x,y)                (sum of derivatives)
GRAD(x,y) = (DX(x,y)**2 + DY(x,y)**2) ** 0.5        (gradient
                                                     magnitude)
D2X(x,y) = [P(x+1,y)+P(x-1,y)-2*P(x,y)]/XDIST**2    (2nd derivative
                                                     in X direction)
D2Y(x,y) = [P(x,y+1)+P(x,y-1)-2*P(x,y)]/YDIST**2    (2nd derivative
                                                     in Y direction)
D2XD2Y(x,y) = D2X(x,y) + D2Y(x,y)            (Laplacian)
```

where P(x,y) is the gray or pigment value at pixel x, line y.

**SUBCOMMANDS:**

(1) -DISPLAY is the subcommand used when one has an IIS allocated and wants to display the results immediately. Images of the derivatives requested will be generated and dropped into the specified channels of the display unit. The minimum and maximum values for each derivative will be used to obtain the initial gray scale of each corresponding image. The button menu may then be used to examine the images and rescale them using other minimum and maximum values, and to save the images as disk files. The original min/max values may be examined using button B2 at any time. The display portion of the proc DERIV is identical to the proc STATDIS. The derivative data files (see parameter OUTFILE) will still reside on disk but may be deleted at the user's request when a satisfactory image is obtained and saved. Note that image files may require substantially less disk space then the corresponding data files. The DERIV-DISPLAY subcommand requires not only that the image display unit be allo-

cated to the user but, if BPLANE is not 0, that the desired blotch reside on its graphics channel.

(2) -NODISPLAY is the subcommand used when one wants to generate derivative data files only. These can then be displayed and saved as image files using STATDIS at a more convenient time or when an IIS is available.

**PARAMETERS:**

Two different parameter menus exist depending on the subcommand entered. Both parameter menus will be described below.

Parameters for "-DISPLAY":

(1) INFILE is the name of the input image file to be processed. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root part of the names of the output data files produced. One output file will be created for each derivative requested. The name of an output file will consist of the name specified by OUTFILE and a suffix corresponding to the derivative. For example, if all seven derivatives are requested and OUTFILE is "TEST", the following files would be created:

TESTDX.DAT,
TESTDY.DAT,
TESTDXDY.DAT,
TESTGRAD.DAT,
TESTD2X.DAT,
TESTD2Y.DAT,
and TESTD2XD2Y.DAT.

It was mentioned above that image files may require substantially less disk space then the corresponding data files specified by OUTFILE. This is illustrated by the fact that if a full image blotch is used, each of these files will require 2049 blocks of disk space as opposed to the normal image file of 513 blocks. The extension ".DAT" will be used by default if it is omitted from the file name.

(3) DX is the display unit channel number (1-14) into which the image of the first derivative in the X direction will be dropped. The null value "--" may be entered to indicate that this derivative should not be calculated. The formula used for DX is given in the Description section above.

(4) DY is the display unit channel number (1-14) into which the image of the first derivative in the Y direction will be dropped. The null value "--" may be entered to indicate that this derivative should not be calculated. The formula used for DY is given in the Description section above.

(5) DXDY is the channel number (1-14) into which the image of the sum of the first partial derivatives will be dropped. The null value "--" may be entered to indicate that this should not be calculated. The formula used for DXDY is given in the Description section above.

(6) GRAD is the channel number (1-14) into which the magnitude of the gradient of the original image will be dropped. The null value "--" may be entered to indicate that this should not be calculated. The formula used for GRAD is given in the Description section above.

(7) D2X is the channel number (1-14) into which the image of the second derivative in the X direction will be dropped. The null value "--" may be entered to indicate that this derivative should not be calculated. The formula used for D2X is given in the Description section above.

(8) D2Y is the channel number (1-14) into which the image of the second derivative in the X direction will be dropped. The null value "--" may be entered to indicate that this derivative should not be calculated. The formula used for D2Y is given in the Description section above.

(9) D2XD2Y is the channel number (1-14) into which the Laplacian image (the sum of the second partial derivatives) will be dropped. The null value "--" may be entered to indicate that this should not be calculated. The formula used for D2XD2Y is given in the Description section above.

(10) IVDX is the output value (in physical units) for pixels that are flagged as "invalid" in the DX output file. Pixels are flagged "invalid" when: 1) the pixels used for a DX calculation are not within the RANGE values, or 2) all the pixels needed for the calculation are not within the image area, i.e. are at image and blotch edges. These pixels are assigned the value IVDX so that they may be given a desired gray level when the image is generated from the data file.By entering a very small number (such as -1E38) one can ensure that the invalid pixels are black (gray level 0) in the image regardless of the data units of the output file. Conversely, a very large number may be used in order to make such pixels white (gray level 255).

(11) IVDY is the output value (in physical units) for pixels that are flagged as "invalid" in the DY output file.

(12) IVDXDY is the output value (in physical units) for pixels that are flagged as "invalid" in the DXDY output file.

(13) IVGRAD is the output value (in physical units) for pixels that are flagged as "invalid" in the GRAD output file.

(14) IVD2X is the output value (in physical units) for pixels that are flagged as "invalid" in the D2X output file.

(15) IVD2Y is the output value (in physical units) for pixels that are flagged as "invalid" in the D2Y output file.

(16) IVD2XD2Y is the output value (in physical units) for pixels that are flagged as "invalid" in the D2XD2Y output file.

(17) XDIST is the distance between pixels in the X direction. The units for XDIST and YDIST must be the same.

(18) YDIST is the distance between pixels in the Y direction.

(19) MODE is a flag indicating whether the pixel values of the image in INFILE represents data (such as temperature) that are linearly related to gray levels or if they represent pigment

concentrations (mg/m3). One should enter a 1 for linear values and a 2 for pigment.

(20) FACTOR is the coefficient by which to divide the gray values of each pixel of INFILE in order to convert them into actual data values. This parameter is used only if MODE = 1, implying a linear data-to-gray mapping function; otherwise, it is ignored. To retain the gray values, one should enter a "1" (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(21) RANGE consists of two values which define the range of input image (INFILE) pixel values to be used for the calculations of derivatives. The derivatives of pixels with values outside those of RANGE will be flagged as "invalid" in the output data files and displayed with a value assigned by IVDX, IVDY, etc. The RANGE values should conform to the units of the INFILE image (i.e. pigment concentration or units linearly proportional to gray levels) as specified by MODE and FACTOR. For example, to exclude only land and cloud pixels, the RANGE values should be 1.0 and 254.0 (the default values) for gray levels (MODE=1 and FACTOR=1) or 0.0425 and 39.0 for pigment concentrations (MODE=2). (To include all pigment values, enter 0 and 40.2.)

(22) ORIGIN is a flag indicating the location of the origin for the image. One should enter a "0" if the origin of the image is at its top left corner or a "1" if the origin of the image is at its bottom left corner.

(23) BPLANE is an integer in the range -7 to 7, the absolute value of which is the graphics plane containing a blotch of the area of interest. If the number is positive, derivatives will be calculated for the area inside the blotch. If the number is negative, the area outside the blotch will be processed. Only blotches defined on the absolute value of BPLANE will be used and the blotch must already be resident in the graphics channel of the display unit. If "0" is entered, the entire image area (512 x 512) will be used and a blotch need not be resident in the display.

<u>Parameters for "-NODISPLAY":</u>

(1) INFILE is the same as for "-DISPLAY".

(2) OUTFILE is the same as for "-DISPLAY".

(3) DX is a flag indicating whether or not to calculate the first derivative in the X direction and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used for the derivative is the same as for "-DISPLAY".

(4) DY is a flag indicating whether or not to calculate the first derivative in the Y direction and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used for this derivative is also the same as for "-DISPLAY".

(5) DXDY is a flag indicating whether or not to calculate the sum of the first partial derivatives and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used is the same as for "-DISPLAY".

(6) GRAD is a flag indicating whether or not to calculate the magnitude of the gradient and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used is the same as for "-DISPLAY".

(7) D2X is a flag indicating whether or not to calculate the second derivative in the X direction and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used for the derivative is the same as for "-DISPLAY".

(8) D2Y is a flag indicating whether or not to calculate the second derivative in the Y direction and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used for this derivative is also the same as for "-DISPLAY".

(9) D2XD2Y is a flag indicating whether or not to calculate the sum of the second partial derivatives (the Laplacian) and output it to a file (OUTFILE). A "YES" should be entered to perform this calculation. The formula used is the same as for "-DISPLAY".

(10) XDIST is the same as for "-DISPLAY".

(11) YDIST is the same as for "-DISPLAY".

(12) MODE is the same as for "-DISPLAY".

(13) FACTOR is the same as for "-DISPLAY".

(14) RANGE is similar to that found under "-DISPLAY" except that the pixels flagged as invalid will be assigned values when using STATDIS to generate the image files from the data files generated in this program.

(15) ORIGIN is the same as for "-DISPLAY".

(16) BLO_FILE is the name of the blotch file which defines the image area(s) of interest when BPLANE is not "0". Only blotches defined on the plane corresponding to BPLANE will be used. Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. A BPLANE value of "0" indicates that the full image is to be processed and BLO_FILE is therefore ignored. The extension ".BLO" will be used by default if it is omitted from the file name.

(17) BPLANE is the same as for "-DISPLAY" except that the plane does not need to be loaded prior to processing. Before using STATDIS, however, this plane of BLO_FILE will need to be loaded.

**IIS BUTTON DEFINITIONS:**
For "-NODISPLAY", no buttons are needed since an IIS is not used for this part of the processing. For "-DISPLAY", IIS buttons are utilized. The button menu, however, is identical to that of the program STATDIS. Therefore the user is referred to that part of the SEAPAK documentation for the definitions.

**PROGRAM NAME:** DICOMED
**DATE:** 4/15/91
**MENU:** MOSAIC

**DESCRIPTION:** This program produces a DICOMED tape for three band images generated using MOSAIC. This tape can then be employed to obtain DICOMED pictures using special hardware. At GSFC, the Information Processing Division and the Space Data and Computing Division both have the capability to make DICOMED pictures. The DICOMED tape is expected to have a density of 800 bpi and store the three images in the sequence of BGR or RGB. More than one three band image can be written on a tape, however, the same sequence, BGR or RGB, must be repeated for successive images. An end of file (EOF) mark separates the BGR/RGB bands and an end of tape mark (double EOF) indicates an end of volume (e.g. a sequence of images would look like B-G-R-B-G-R . . . -B-G-R-- where a "-" indicates an EOF mark). In each band, each tape record is output to one picture line.

**PARAMETERS:**
(1) INFILE is the list of three band images one wants to output to a DICOMED tape. Up to 12 valid host file names can be entered. All the input files should be 3 band, 512x512 images with no header block and generated with the program MOSAIC. The extension ".RGB" will be used by default if it is omitted.
(2) TAPE specifies the tape drive being used. The inputs are: 0 for MFA0:; 1 for MFA1:; 2 for MSA0:; 3 for MTA0: and 4 for MTB0:.
(3) PICTURE defines which scene on the tape INFILE(1) represents. If this is a new tape, one should enter a value of 1.
(4) RGB indicates the RED, GREEN, BLUE sequence to be employed. A "1" should be entered if the tape is to be processed by the Space Data and Computing Division in Building 28 where the DICOMED machine is set up for a RGB sequence. A "2" should be entered if the tape is to be processed by the Information Processing Division in building 23 where the DICOMED machine is set up for a BGR sequence.

**IIS BUTTON DEFINITIONS:**
No buttons are required for this program.

**PROGRAM NAME:** DIFFI
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** DIFFI lets you obtain a difference image file from two input image files. Two modes of differencing are provided. The linear differencing generates difference in actual gray level units. The chlorophyll differencing is for pigment concentration images where the conversion of the display unit to pigment concentration follows the Nimbus Experiment Team's equation instead of a linear equation. The differencing takes place such that input image file 2 is taken away from input image 1. A gray level is designated by the user to represent the pixels where there is no difference between the two input images and thus serves as an offset to the positive and negative differences. For example, in a linear mode, if a value of 128 is designated to represent this zero difference level, pixels with a difference of 5 will be displayed in a gray level of 133 and pixels with a difference of -5 will be displayed by a gray level of 123. This proc is not as general as ADDF but does the same thing for simple differences in addition to providing the user with an immediate output image.

**PARAMETERS:**

(1) IN1 is the input disk file name for the first image. The extension ".IMG" will be used by default if it is omitted for this parameter as well as for IN2.

(2) IN2 is the input disk file name for the second image. This image is subtracted from IN2.

(3) OUT is the name of the output disk file image containing the difference of IN1 and IN2. The extension ".IMG" will be used by default if it is omitted.

(4) MODE specifies the data mode for differencing. The user should enter a "1" to specify a linear mode or a "2" to specify a pigment mode. In linear mode, the difference is taken directly using the gray levels of each pixel of the input image files and then multiplied by WEIGHT. In pigment mode, the corresponding pigment values of each pixel of the input files are first determined. The difference is then taken in pigment values and multiplied by WEIGHT. Finally, this difference is converted back to display units with pigment mapping equations.

(5) ZERO is the gray level value to be assigned to pixels with no difference between the two input images. This ZERO value serves as an offset for the positive and negative difference values. This is a very important parameter since negative difference values cannot be displayed. For example, in a linear mode, if the user specifies a ZERO value of 128, all the pixels with a difference value of 50 will be displayed with the gray level 178 (128 + 50), while all the pixels with a difference value of -50 will be displayed with the gray

level 78 (128 - 50). This parameter can have any integer value in the range [0,255].

(6) WEIGHT is the multiplicative factor for the difference, i.e. OUT=WEIGHT*(IN1-IN2)+ZERO. Note that a careful choice of the parameters WEIGHT and ZERO are required to obtain a meaningful image, i.e. one whose values stay within the screen range of [0, 255]. If values are outside this range, they will be set to 0 if less than 0 or 255 if more than 255.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** DK2IMG
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** This program generates 512 x 512 disk image files from a disk file containing a level-1 CZCS scene in NOPS format (described in Williams et al., 1985a) preceded by header information. These types of scene files, which normally have the extension ".NI7", are generated by the CZCS archive activity at NASA's Goddard Space Flight Center from NOPS format tapes. An output image file is created for each of the six CZCS channels. (See help text for input parameter OUTFILE.)

**PARAMETERS:**

(1) INFILE is the name of the host file containing the CZCS level-1 scene to ingest. The extension ".NI7" will be used by default if it is omitted from the file name.

(2) DEVICE is the name of a device which contains INFILE and which must be mounted. The device will be mounted for reading only and will be dismounted after program execution. For example, "LDB0" or "LDB1" may be entered to mount the optical disk drives on the DIATOM node of the Laboratory for Hydrospheric Processes' local area VAX cluster.

(3) REDFAC is the reduction factors for the horizontal (along scan) and vertical (along orbital track) directions, in that order. Positive values indicate reduction by subsampling whereas negative values indicate magnification by pixel replication. For example, an entry of (2,2) will create images half as wide in samples and half as high in scan lines as the scene area defined by WINDOW; an entry of (-2,-2) will generate images twice as high and wide. Note that reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Values of -1, 0, or 1 are equivalent and generate images having a one-to-one correspondence of pixels with the tape scene.

(4) OUTNAME is a file name to use as the basis for the names of the output files created by this proc. If a device is not specified, "SCRATCH:" will be used; if the device and the directory are not specified, the user's root (main) directory will be used. The extension ".IMG" will be used by default for the output image files if it is omitted from the file name. The name must be a valid host file name. An index will be inserted prior to the "." of the extension. For example, if OUTNAME = "CZCSIMG", the following files will be created:

```
SCRATCH:[acctname]CZCSIMG1.IMG    >    Channel 1 (443 nm)
SCRATCH:[acctname]CZCSIMG2.IMG    >    Channel 2 (520 nm)
SCRATCH:[acctname]CZCSIMG3.IMG    >    Channel 3 (550 nm)
SCRATCH:[acctname]CZCSIMG4.IMG    >    Channel 4 (670 nm)
SCRATCH:[acctname]CZCSIMG5.IMG    >    Channel 5 (750 nm)
SCRATCH:[acctname]CZCSIMG6.IMG    >    Channel 6 (11.5 um)
```

SCRATCH:[acctname]CZCSIMG.CTL > Navigation control point file.

(5) WINDOW defines, in conjunction with REDFAC, the area of the tape scene to use for generating the SEAPAK images. WINDOW(1) and WINDOW(3) specify the positions of the first and last samples (data points along scan lines), respectively, to use from each scan line. Note that sample positions are numbered from the start of each scan. Since CZCS data were only collected while the satellite was ascending (flying south to north), sample 1 will be the westernmost sample of each scan. WINDOW(2) and WINDOW(4) specify the first and last scan line numbers to ingest from the scene. CZCS level-1 scenes have a maximum of 970 scan lines corresponding to two minutes of data and a fixed number of 1968 pixels per scan line. Since TPCZCS generates only 512x512 pixel image files, subsampling is required to generate an overview of the scene. Blank pixels on the side margins and lines at the bottom of an image are added if the data do not fill the 512x512 array. An error message is generated if an improper combination of reduction factors and window values is input.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** DLINE
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** DLINE is used to draw lines in the graphics (or bit) planes of an image display terminal. After one has selected the number of the bit plane in which to draw the line, via the input parameter PLANE, the user selects the first end point of the line. This is done by using the trackball to move the cursor to the desired location and then depressing the IIS button A3 ("Change vertex"). Now as one moves the cursor, the computer draws a line from this original vertex to the current cursor position. When the user has decided where the line should be drawn, the "Draw line" button (B3) is depressed. This vertex becomes the end point for the previous line as well as the beginning for the next line unless the "Change vertex" button is pressed. The various line segments can be drawn in different planes (and hence different colors) if desired by using the "Change plane" button (C3).

**PARAMETERS:**

(1) PLANE is an integer between 1 and 7 that specifies the graphics bit plane in which the lines will be drawn. The default colors for the planes are as follows:

| | |
|---|---|
| plane 1==>pink | 5==>orange |
| plane 2==>red | 6==>cyan |
| plane 3==>green | 7==>sand |
| plane 4==>yellow | |

The proc BPCOLOR can be used to change the colors of the planes if that is required.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Vertex | Draw Line | Change Plane | Erase Line | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button allows one to change the vertex to the current location of the cursor. This location then becomes the beginning of a new line.

B3: Depressing this button causes the currently displayed line to be fixed. The end of the line becomes the new vertex for the next line.

C3: If one wants to change to another graphics plane, this button should be depressed. It will ask the user to input a new value for PLANE.

D3: If the user decides to erase a line just drawn, this button will accomplish the task. Note that other previous lines cannot be erased.

F3: This exits DLINE and returns the user to SEAPAK.

**PROGRAM NAME:** DMPHDR
**DATE:** 4/15/91
**MENU:** HEADER

**DESCRIPTION:** DMPHDR is used to dump the header information stored in the first block of an image generated by SEAPAK. The information normally contained in this header is given in Table 1. These are primarily parameters determined from the tape ingest of a level-1 scene. Table 2 shows the header parameters that are changed by the programs EOF and DERIV. Table 3 shows those parameters changed by STATDIS.

**Table 1.** Regular image parameters that are displayed.

| | | | |
|---|---|---|---|
| 1. | Area Code | 20. | Solar Azimuth |
| 2. | Start Year | 21. | Roll |
| 3. | Start Day | 22. | Pitch |
| 4. | Start Time | 23. | Yaw |
| 5. | Orbit Number | 24. | Slope - Channel 1 |
| 6. | Center Latitude | 25. | Intercept - Channel 1 |
| 7. | Center Longitude | 26. | Slope - Channel 2 |
| 8. | Corner Latitude 1 | 27. | Intercept - Channel 2 |
| 9. | Corner Longitude 1 | 28. | Slope - Channel 3 |
| 10. | Corner Latitude 2 | 29. | Intercept - Channel 3 |
| 11. | Corner Longitude 2 | 30. | Slope - Channel 4 |
| 12. | Corner Latitude 3 | 31. | Intercept - Channel 4 |
| 13. | Corner Longitude 3 | 32. | Slope - Channel 5 |
| 14. | Corner Latitude 4 | 33. | Intercept - Channel 5 |
| 15. | Corner Longitude 4 | 34. | Slope - Channel 6 |
| 16. | Gain | 35. | Intercept - Channel 6 |
| 17. | Threshold | 36. | Tilt information |
| 18. | Solar Elevation | 37. | Epsilon values |
| 19. | Tilt Angle | | |

**PARAMETER:**
(1) INFILE is the file name of the image whose header is to be read.

**Table 2.** Header parameters changed by DERIV and EOF.

| | |
|---|---|
| 13. | Minimum Mean Value (for EOF only) |
| 19. | Maximum Mean Value (for EOF only) |
| 20. | Number of Processed Pixels (for EOF only) |
| 24. | Minimum Data Value |
| 25. | Maximum Data Value |

**Table 3.** Header parameters changed by STATDIS.

| | |
|---|---|
| 24. | Slope for mapping from gray level to real data units |
| 25. | Intercept for mapping from gray level to real data units |

**BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** DRIFT
**DATE:** 4/15/91
**MENU:** ANCPROG

**DESCRIPTION:** This program runs a demonstration on the IIS model 75 of selected SEAPAK ancillary data processing programs. The user can interactively run each program with sample images and data which are provided, and then exit each application to move on to the next. The following SEAPAK program (currently only one) will be run: DRIFTER. The user should refer to the write-up on this program for more information on its operation.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Check the individual program called by this program for a description of its button menu.

**PROGRAM NAME:** DRIFTER
**DATE:** 4/15/91
**MENU:** UNGRIDANL

**DESCRIPTION:** This program supports the analysis and plotting of drifter tracks from FGGE (either unprocessed or Patterson processed), NODC, Reverdin/FOCAL, and Sequal/FOCAL. Any or all drifter tracks from a file output from program RDDRIFTER can be plotted to the IIS, Tek or HP devices. On IIS model 75, tracks can be plotted using a loaded image to define the graphics region (by invoking the program with subcommand -IISD), or drawn to the screen using maps/grids for background reference (by invoking the program with subcommand -IISN). Specifying subcommands -TEK and -HP, respectively, will invoke the program for these devices. The user, when running interactively, can specify a particular track to analyze in order to print out speeds/movements along the track or generate an x/y plot of a parameter's value vs. point along the track. Tracks can optionally be color-coded based on the value of a particular parameter and specified data break points and corresponding colors. Graphics commands used to draw the tracks on the Tektronix or HP devices can be saved in a file created during a batch run, so that large numbers of tracks can be displayed without user intervention.

**PARAMETERS:**

(1) INASC (used for all subcommands) is the name of the input drifter track ASCII data input file output by program RDDRIFTER (or EDTDRIFT if editing was performed on the data).

(2) DRFT_ID (used for all subcommands) is a list of up to 7 track numbers to plot from INASC. The sequence numbers are indicated after the field labelled SEQUENCE in the 5th header line of each drift in file INASC. If the user enters a null value for DRFT_ID, all drifts in the file will be read, in groups of 7. This means that, if running interactively, only the last group of up to 7 drifts will be available for analysis (i.e. listing speed along tracks and/or plotting specific parameters' values on an x/y plot). Alternatively, the user can list specific sequence numbers for DRFT_ID (only up to 7 specific tracks can be plotted at a time). When doing this, they should be listed in order of increasing sequence number.

(3) SUBSMP (used for all subcommands) is the sampling frequency for reading drifter data, plotting tracks and drawing x/y plots of data. This is the point increment used when ingesting the data for the specified tracks. This will also define the point increment for an x/y plot of data, if generated, and also the point increment for the track plots themselves. It allows the user a quick way to see long tracks.

(4) DREGION (used for subcommands -IISN, -TEK and -HP) is the optional data region specification. Value 1 in the array is

the southernmost latitude, value 2 is the northernmost latitude, value 3 is the westernmost longitude, value 4 is the easternmost longitude. For subcommand -IISD, the image limits, as specified in the header, define the data region. If DREGION is null, the ingested tracks will define the data area for plotting (i.e. the entirety of each track will be plotted as long as it lies within the graphics region GREGION). If DREGION is specified, a border (in plane/index 1) will be drawn around this region on the display device and only the portions of tracks falling within DREGION will be plotted. If DRFT_ID is null, either DREGION or GREGION must be specified.

(5) GREGION (used for subcommands -IISN, -TEK and -HP) is the optional graphics region specification. Value 1 in the array is the southernmost latitude, value 2 is the northernmost latitude, value 3 is the westernmost longitude, value 4 is the easternmost longitude. If GREGION is null, it will be made into a 10% expansion in both latitude and longitude of DREGION (on all 4 sides of the box defined by DREGION). This is true for subcommmands -IISN, -TEK and -HP. For -IISD, GREGION is not user-definable; it is defined by the image header (i.e. GREGION is the entire image). If GREGION is specified (subcommands -IISN, -TEK and -HP), the entire device space will cover this region, and DREGION will be a subset of this region (see help for DREGION for elaboration). If DRFT_ID is null, either DREGION or GREGION (or both) must be specified.

(6) GPLANE (used for all subcommands) are the values of graphic planes/color indices for displaying the drifter tracks. These values will be used to draw the track labels (i.e. sequence numbers) when color coding is done, and the entire track including the label when color coding is not done. DRFT_ID(1) will be drawn in GPLANE(1), DRFT_ID(2) will be drawn in GPLANE(2), etc. If DRFT_ID is null (i.e. all tracks to be ingested), and there are more than 7 tracks, modular arithmetic is used on the DRFT_ID number to get a value for GPLANE -- i.e. track 8 uses GPLANE(1), track 9 uses GPLANE(2), etc. If GPLANE is null, a default set of values from 1 to 7, numbered consecutively, is assigned to each group of 7 tracks.

(7) OUTASC (used for all subcommands) is the optional filename of the output ASCII data file with track movement information. When running interactively, this contains speeds and headings of points along the track specified by ANLTRK, at increments specified by PTINC, starting at a point specified by PTSTRT. In batch mode, speeds and headings of ALL tracks specified by DRFT_ID, at increments specified by PTINC, starting at a point specified by PTSTRT, will be written to file OUTASC. Note that speed/heading cannot be computed at the first physical point along a track, since there is no preceding point to compare it with. The file OUTASC, if provided, will automatically be created when running in batch mode. For interactive mode, the data for ANLTRK is written to OUTASC each time IIS model 75 button B3 is pressed (when program is activated with

subcommands -IISD or -IISN) or each time choice 6 is selected (when program is activated with subcommands -TEK or -HP).

(8) ANLTRK is the track number from INASC to analyze (e.g. to produce speed/movement information or an x/y plot of the PARM_PLT parameter). If DRFT_ID is null, ANLTRK must be from the last group of 7 (if the total number of tracks is divisible by 7). If DRFT_ID is specified, ANLTRK can be any of these. This parameter is ignored in batch runs. The data for the entire track of ANLTRK is written to OUTASC each time the IIS model 75 button B3 is pressed (when the program is activated with subcommands -IISD or -IISN) or each time choice 6 is selected (when the program is activated with subcommands -TEK or -HP). Data for one point at a time along ANLTRK can be written to the user's terminal by specifying IIS button A2 or dynamic tutor choice 2. Each selection will increment a counter starting at PTSTRT by an amount PTINC and the data for that point will be written to the screen. Note that speed/heading cannot be computed at the first physical point along a track, since there is no preceding point to compare it with.

(9) PTSTRT (used for all subcommands) is the sequence number of the first point from ANLTRK (interactive mode) or from each of the tracks specified by DRFT_ID (batch mode) for which speed/heading information will be printed to the screen or file OUTASC. Note that speed/heading cannot be computed at the first physical point along a track, since there is no preceding point to compare it with. When requesting an x/y plot of data, PTSTRT is ignored; the plot always starts at the beginning of the track.

(10) PTINC (used for all subcommands) is the printing increment (in points) for speed/heading along ANLTRK (interactive mode) or for each of the tracks specified by DRFT_ID (batch mode) for speed/heading information. Note that the speed/heading is printed for a point in the original, full-resolution track equal to PTINC*SUBSMP - i.e. if SUBSMP is 2 and PTINC is 2, successive requests for movement information will be valid at full-resolution point 5 (point 1 is never used), point 9, point 13, etc. When requesting an x/y plot of the data, PTINC is ignored; only SUBSMP determines the increment (and total number of points) for an x/y plot.

(11) CLEAR (used for subcommands -IISN, -TEK and -HP) is a flag for indicating whether to clear graphics before drawing the current set of tracks. Specify a "Y" to clear the screen prior to drawing each set of tracks (i.e. a clear will be executed each time a new set is drawn) or "N" not to clear pre-existing graphics.

(12) BRK_PLN (used for all subcommands) is an optional list of the graphics planes/color indices for the display of values in ranges specified by BREAKS, used for color coding the tracks if specified. The same number of inputs as for BREAKS should be specified. See the information for BREAKS for an elaboration.

(13) BREAKS (used for all subcommands) are the optional data breaks (for PARM_PLT) for color coding drifter tracks. These breaks define ranges of the parameter in PARM_PLT for which different colors are assigned in the track drawn. BREAKS(1) through BREAKS(2) will be drawn in color BRK_PLN(1), BREAKS(2) through BREAKS(3) will be drawn in BRK_PLN(2) .... BREAKS(n) and larger values will be drawn in BRK_PLN(n) where n is the number of inputs for both BREAKS and BRK_PLN.

(14) PARM_PLT (used for all subcommands) is the optional mnemonic of the parameter to be used for x/y plots using the default track, or for color-coding one or more tracks. If left null, no color-coding of the tracks will be done; the entire length of each track will be plotted in a color defined by GPLANE (the array index corresponding to this track's array index in DRFT_ID). If a value for PARM_PLT is specified, color coding will be performed using the values of BREAKS and BRK_PLN (i.e. each successive two values in BREAKS defines a range to be plotted in color BRK_PLN), and the user will also be able to generate an x/y plot of the parameter in PARM_PLT vs. number of points along the track.

(15) ANNOT (used for subcommands -IISN, -TEK or -HP) is an optional annotation string for drifter track plots. If specified, the character string specified will be put at the bottom of the track plot in the graphics plane/color index number 1.

(16) MAP_TYP (used for subcommands -IISN, -TEK or -HP) is an optional background map's resolution, type and projection. Value 1 of the array is the resolution, value 2 is the bounds type, value 3 is the projection. For value 1, specify one of the following values: "HI", "ME" or "LO" for high, medium or low resolution maps, respectively. For value 2, specify "RE", "PO" or "CO" for regional, political (country/state) or coastline boundaries. For value 3, specify "CED", "MCD", "MER", "NPS", or "LCC" for cylindrical equidistant, modified CED, mercator, north polar stereographic or Lambert conic conformal (for the northern hemisphere), respectively. The General Meteorological Package, GEMPAK, is used to draw these maps, which are part of its database.

(17) MAP_PLN (used for subcommands -IISN, -TEK or -HP) is the optional background map's graphics plane/color index. Graphics plane is used on the IIS model 75, color index is used on the Tektronix terminal or HP plotter.

(18) GRD_RES (used for subcommands -IISN, -TEK or -HP) is the resolution and label frequency for the optional grid overlay. Specify the latitude resolution in degrees for the grid in GRD_RES(1), the longitude resolution in degrees for the grid in GRD_RES(2), and the labelling frequency for the grid in lines in GRD_RES(3). Specify a 0 for GRD_RES(3) to suppress line labels.

(19) GRD_GPL (used for subcommands -IISN, -TEK or -HP) is the graphics plane/color index for the optional grid overlay. Graphics plane is used on the IIS model 75, color index is used on the Tektronix terminal or HP plotter.

(20) OUTMAP (used for subcommands -TEK or -HP) is the optional filename of the output map command (HP or Tektronix) file. For -TEK, this name is only used for batch runs; it is ignored for interactive runs. The file will contain either Tektronix or HP 7550A plotter commands which will plot the requested set of commands when the file is retyped (with the DCL "type" command) to the screen (Tek) or sent to the plotter (HP). It is created when the user invokes subcommand -TEK and runs the job in batch, or invokes subcommand -HP and runs the job interactively or in batch. An HP file can be sent to the plotter at the Laboratory for Hydrospheric Processes Computing Facility from within the program (specify QUEUE="Y") or after the program runs by typing "HPLOT" followed by the OUTMAP filename at the DCL prompt.

(21) QUEUE (used for subcommand -HP only) is a flag for whether to send a plot file to the HP7550 plotter in the Laboratory for Hydrospheric Processes Computing Facility. Specify "Y" to send the file OUTMAP to the queue when the program run completes, while "N" will result in no spooling to the plotter queue of file OUTMAP.

(22) PTITLE (used for all subcommands) is the bottom title of up to 80 characters in length to be placed on an x/y plot of drifter data, if requested. This is only used for interactive runs only. The plot is of the field specified in PARM_PLT vs. points along the track specified in ANLTRK.

(23) LOCPLT (used for subcommands -IISN, -HP or -TEK) is the location on the output device of the x/y drifter data plot, if requested. The plot is of the field specified in PARM_PLT vs. points along the track specified in ANLTRK. Possible inputs are: 1 for a full screen plot, 2 for a plot on the top half of the screen, 3 for a plot on the bottom half of the screen, 4 for a plot on the upper left of the screen, 5 for a plot on the upper right of the screen, 6 for a plot on the bottom left of the screen, 7 for a plot on the bottom right of the screen. By specifying plot location, the user can minimize the chance of overlap between the plot and plotted drifter tracks, if any.

**DYNAMIC PARAMETERS:**
All of the parameters above will appear in dynamic tutors as well, since it is possible to change any of the original inputs during a given run, with IIS button F1 or tutor choice 1.

**IIS BUTTON DEFINITIONS:**
When the IIS is being used, the button menu is the means to interactively react with DRIFTER. Each button initiates a certain action requiring further input, thus the user will be prompted for more parameters. These parameters are defined in the section PARAMETERS.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Choose track to be analyzed | Create file with movements-current track | | | Exit |
| 2 | Step thru current track, showing movement | Create x/y plot for current track | Draw tracks, using current settings | | Invoke BPEDIT |
| 1 | | | | | Modify original tutor inputs |

A2: This button enables the user to print to the screen the speed and heading information for the next point along ANLTRK. Each successive button push will print information for points PTINC apart, with the first point at PTSTRT. A message will be printed when the user reaches beyond the end of ANLTRK.

A3: This button controls the choice of ANLTRK, the track for which speed/heading information is to be computed or an x/y plot of track data created.

B2: Pressing this button will result in the creation of an x/y plot of data (along y axis) vs. distance (along x axis) for track ANLTRK. The number of points plotted is determined by the values of PTSTRT and PTINC. The value of LOCPLT determines where on the model 75 display screen the plot will be drawn. The string defined by PTITLE will be placed at the bottom of the plot. The plot will be drawn in the graphics plane GPLANE.

B3: This button will result in the creation of a file with the speed/movement at each point along track ANLTRK, at intervals PTINC apart, starting at point PTSTRT. This is equivalent to pressing A2 for every point along the track.

C2: This button will result in the plotting of all tracks specified by DRFT_ID and having characteristics specified by the other parameters. This is used after one of these parameters has been changed, since running the program initially will automatically result in tracks being plotted using the initial set of inputs.

D1: The user will be able to change any of the initial set of inputs with this button, before regenerating the track plots, x/y data plots, or speed/movement information.

D2: This button will invoke program BPEDIT, the bit plane editor, so that the user can modify the overlay in any way they wish.

F3: This button is used to exit the program.

**PROGRAM NAME:** DSPIMG
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** DSPIMG will generate an image file in SEAPAK format (counts, header, etc.) from a level 1, 2, or 3, CZCS or AVHRR image file created on the University of Miami's DSP image analysis system.

**PARAMETERS:**

(1) DSP_IMG is the name of a disk file containing the DSP image to be converted. The DSP image may be a level 1, 2, or 3 (mapped or unmapped) CZCS or AVHRR image. The name must be in DSP syntax and include the subimage name and the desired band name, if any: "filename/subimage/band". If "/band" is incorrect, the first band will be used by default and a message will be displayed indicating the band name that was used. If the directory (path) is not specified, the current directory is assumed. "PST" subimages are not valid but may be converted to SEAPAK images using the proc PSTIMG.

Examples:

1) "801178112821.NI7-1/INGEST/3" could be a DSP level 1 CZCS image in the current directory.
2) "SIA5:[account.subdir]801178112821.FM4/CHL13/CHLOR" could be a DSP level 2 CZCS image in a specified subdirectory.

(2) OUTFILE is the name of the disk file to create for the SEAPAK image converted from DSP_IMG. The extension ".IMG" will be used by default if it is omitted from the file name. The image created is equivalent to an unmapped SEAPAK image having an associated control point file regardless of whether DSP_IMG is mapped or unmapped. An unmapped SEAPAK image is one which has not been mapped using the proc MAPIMG. Note that this means it may or may not correspond to a satellite perspective. If the input data is pigment, it will be converted to SEAPAK's pigment scale; otherwise, the input (DSP) calibration (scaling) will be maintained.

Level 1 DSP images are normally unmapped, having a satellite perspective where north is at the bottom and west is on the left. For such images, OUTFILE will be created such that north is at the top and west is on the left but will otherwise retain the same perspective (projection). This north-at-the-top orientation is the convention for SEAPAK ingested level 1 images and makes it is easier for users to recognize landmarks.

A level 2 DSP image which has not been mapped into a projection different from the satellite perspective is flipped so that north is at the top and west is on the left. For such images and for those which have been mapped, OUTFILE will

have the same projection and orientation. However, note that the projection of OUTFILE will be affected if REDFAC(1) does not equal REDFAC(2) since the aspect ratio of OUTFILE relative to DSP_IMG will not be one.

(3) OUT_SIZE specifies the width and length of OUTFILE. The default values are for a standard SEAPAK image of 512x512. The width may range from 1 to 2048 and the length may range from 1 to 1024.

OUTFILE will be a fixed-length file with record lengths of OUT_SIZE(1) bytes. Each byte represents a gray value for the output image. The number of records will be OUT_SIZE(2) plus a header record if HEADER="YES." Note that if OUT_SIZE(1)<512, any header record will be truncated to that size.

To generate a standard SEAPAK image file, HEADER must be "YES" and OUT_SIZE must be (512,512). Otherwise, OUTFILE will not be a valid SEAPAK image for use with other procs.

(4) HEADER requires "YES" or "NO" to indicate whether or not to write a SEAPAK image header at the beginning of OUTFILE. Note that, if OUT_SIZE(1)<512, the header record will be truncated to that size.

(5) REDFAC are the reduction factors for the pixel and line directions (in that order). Positive values indicate subsampling (reduction) whereas negative numbers indicate zooming in (expansion) by pixel replication. For example, a value of (2,2) will create an image half as high and wide in pixels as the pixel area defined by WINDOW; an entry of (-2,-2) will generate an image twice as high and wide. Note that the reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Acceptable values are (0, 1, 2, 4, -1, -2, or -4). However, values of -1, 0, or 1 are equivalent and generate an OUTIMG having a one-to-one correspondence of pixels with DSP_IMG.

(6) WINDOW defines the start pixel, start line, end pixel and end line to use from the image defined by DSP_IMG. For mapped or level 2 DSP images, these indices refer to the location from the top and left of the DSP image. In the case of unmapped level 1 DSP images, the indices refer to the location from the top and left with the image assumed oriented with north at the top and west on the left.

Note that the REDFAC values are also applied to the WINDOW indices. For example, if REDFAC=(2,2) and WINDOW = (1,1,1024,1024), the top left 1024 pixel square of DSP_IMG will be used to generate a 512x512 OUTFILE. If WINDOW and REDFAC define an image area greater than the maximum number of SEAPAK image pixels or lines (512), the leftmost and topmost portion of the image defined by WINDOW will be used so as not to exceed that maximum, i.e. the bottom most and right most part of the image in WINDOW will not be used.

(7) DYNNAME: After DSPIMG is invoked, it may require the dynamic SCALE and BIAS parameters if the DSP_IMG image file data (such as original AVHRR data) are not in one-byte-per-pixel format.

If a TAE parameter file name is entered for DYNNAME and non-byte/pixel data are used, the program will obtain the values for these parameters from the DYNNAME file. A disk and directory path may be specified explicitly with the file name; otherwise, the current disk and directory are assumed. The default file name extension is "PAR".

If DSPIMG is being run interactively and DYNNAME is blank or is the null value "--" (default), the program will prompt for SCALE and BIAS via a dynamic tutor session. The default values of these parameters will be those recorded in the DSP image header. If DSPIMG is being run as a batch job and DYNNAME is blank or null, these default values will be used automatically.

The parameter file for DYNNAME may be created by running DSPIMG interactively with DYNNAME="--" and using a DSP_IMG image of non-byte/pixel data. When the dynamic tutor is invoked, the desired values for SCALE and BIAS may be entered then, followed by the SAVE command, followed by the EXIT command so as not to continue with the execution of DSPIMG. The name (if any) entered with the SAVE command may be used for DYNNAME when running DSPIMG again. If no name is entered with the SAVE command, the default name "DSPIMGDYN.PAR" will be used by SAVE and that parameter file will be created in the current directory. In such a case, the name entered for DYNNAME when running DSPIMG again should be "DSPIMGDYN".

(8) DEVICE is the name of a device which contains DSP_IMG and which must be mounted. The device will be mounted for reading only and will be dismounted after program execution. For example, "LDB0" or "LDB1" may be entered to mount the optical disk drives on the DIATOM node of the Laboratory for Oceans' local area VAX cluster.

**DYNAMIC PARAMETERS:**

Ordinary SEAPAK images require 8-bit data to represent pixel values. If the input data are not in 8-bit form, the following SCALE and BIAS parameters will be required for their conversion. The default SCALE and BIAS values will normally be 0 unless they were modified using a DSP program such as CONVRT (which may also be used to convert the DSP image to 8-bit format). The SCALE and BIAS values are incorporated into the data's slope and intercept values stored in the output file's header so that other SEAPAK programs may regenerate the original values.

(1) SCALE is a parameter for shifting the input binary data. The following equation defines its use:

SEAPAK_img_value = (DSP_img_value * 2**SCALE) - BIAS

For example, original AVHRR data values range from 0 to 1024, requiring up to 10 bits stored in two bytes (8 bits per byte). By using SCALE=2, the two least significant bits will be lost as all bits are shifted two places. The program will then

retain the lower byte, which now contains all possible values, when generating a SEAPAK image. Note that when SCALE>0, some loss of the original data value resolution will occur when the original data are regenerated for subsequent use.

(2) BIAS is the intercept used with SCALE in the above equation.

**IIS BUTTON DEFINITIONS:**

The IIS is not required for this proc.

**PROGRAM NAME:** EDTDRIFT
**DATE:** 4/15/91
**MENU:** UNGRIDANL

**DESCRIPTION:** This program allows modification of any data field in up to 50 ASCII files generated by program RDDRIFTER (drifter track data listing) or DRIFTER (drifter track speed listing). The user can specify up to 10 parameters to be modified in each of these files, along with their valid minimum and maximum values. Values falling outside of this range are flagged as missing, with the flag written to a new version of the ASCII file. An additional test can optionally be applied, which looks at the change of the parameter over a specified distance. Even if a value falls within the valid min/max range, it may be flagged as missing if its spatial change at this point is above the specified threshold amount. This second test is generally used only for RDDRIFTER output (data listing) since the track speed in the DRIFTER output is computed directly from latitude/longitude positions. Note that a given run will usually contain input file names all of the same type (either RDDRIFTER output or DRIFTER output) since the list of parameters specified for editing will be searched for in each input file, and the two types of input files never share the same parameter names.

**PARAMETERS:**
(1) INASC is the name of the ASCII file containing unedited drifter data. Specify the same number of values for INASC as OUTASC.
(2) OUTASC is the name of the ASCII file containing edited drifter data. Specify the same number of values for OUTASC as INASC.
(3) PRMEDT is the list of parameters to edit from INASC. These are the mnemonics from the RDDRIFTER or DRIFTER ASCII file representing the parameters to be edited. NOTE: They MUST appear in the same order, reading left to right, as is found in INASC, i.e. if SFTMP appears to the left of SLPRESS in INASC, SFTMP should precede SLPRESS in the list of parameters in PRMEDT. Possible inputs are: SFTMP, SALIN, BDPT, AIRTMP, SLPRESS, WD_DIR, WD_SPD, QC_SST, QC_PRS, QC_LOC, E_VEL, N_VEL, N_ACCEL, QC_PROC (from RDDRIFTER output) or SPD, U, V, and HEADING (from DRIFTER output).
(4) RANGE is the list of valid minima/maxima for PRMEDT. The user should specify the minimum followed by the maximum for each parameter to be edited, in sequence. Twice as many inputs for RANGE as for PRMEDT must be specified. Values greater than the maximum or less than the minimum are flagged as missing in the edited file OUTASC.
(5) DELT_PRM is the maximum expected change in PRMEDT over the value DISTANCE. This is an optional input. If entered, a single value corresponding to each value of PRMEDT must be entered, representing the expected maximum change of this parameter over a distance specified by parameter DISTANCE. This will be used as an additional test when reading INASC.

If the change in PRMEDT between two consecutive points exceeds DELT_PRM/DISTANCE, a missing flag is put in OUTASC at the second of these points.

(6) DISTANCE is the distance in kilometers (in the range 0.001 to 10,000) corresponding to DELT_PRM. This is an optional input. If entered, a single value corresponding to each value of PRMEDT must be entered, representing the distance over which PRMEDT is expected to change by an amount equal to DELT_PRM. This will be used as an additional test when reading INASC. If the change in PRMEDT between two consecutive points exceeds DELT_PRM/DISTANCE, a missing flag is put in OUTASC at the second of these points.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** ENVIMG
**DATE:** 4/15/91
**MENU:** GRIDANL

**DESCRIPTION:** This program allows the user to create an image file from NORDA's 5-minute resolution bathymetry data, a gridded environmental data ASCII file, or any Common Data Format (CDF) file at resolutions of up to 512 latitudes by 512 longitudes, present on disk or SONY optical platters, by explicitly specifying the latitude/longitude bounds or by selecting it from an overview image. The output image can be any size on the IIS display, and is obtained through either a bi-linear or bi-cubic spline interpolation where necessary. For any image created, latitude/longitude, data value and gray level can be read at the cursor point. Data type, times, latitude/longitude limits, parameter, gray level/data scalings, image size and interpolation type can all be changed during a single run of the program.

The user invokes the program with one of the subcommands: -IIS (for running interactively, displaying the image on the IIS model 75), -BATHY (to create images from NORDA bathymetry), -CDF (to create images from Common Data Format files), or -ASC (to create images from ASCII files generated from other programs, such as ASCENV). All but subcommand -IIS can be used to generate images in a batch mode, since they write images directly to disk and not the IIS model 75 display.

**DATA AVAILABILITY:**
A current list of all the available CDF data sets can be found in the file:

CDF$DAT:ENVDATA.LIST

Further information on the parameters etc. can be obtained using the program CDFLST.

**PARAMETERS:**
(1) MODE for selecting the latitude/longitude limits. A "1" should be entered to specify latitude/longitude directly and a "2" to select latitude/longitude from an overview image previously created by the program. For NORDA bathymetry data, a single overview is kept on disk and dropped to IIS memory (in channel specified by parameter GLBCHN) since this is not time-dependent.
(2) INCREM is the time increment which will be used to select times for the data between the start and end times specified in DATES. One per image (up to four) should be selected. The format is:
YYMMDDHH for CDF data sets.
(3) GLBCHN is the IIS channel to hold the overview image mentioned under MODE above.
(4) DATTYP is the data type for the image. The following is a list of possible entries:

NORDA = NORDA Global bathymetry
CDF = NSSDC Common Data Format
ASCII = ASCII file input (created by any environmental data program)

(5) DATE specifies the start and end dates for the image requested. The first value entered corresponds to the start time of the image and the second value corresponds to the end time. The format is:
YYMMDDHH for CDF data sets.
This parameter is ignored for bathymetry.

(6) SONY is a flag indicating whether to mount one or both SONY WORM drives for use in running ENVIMG. If the default "--" (null) is entered, the program will not use the SONY. If "0" is entered, drive DIATOM::LDB0 will be mounted. If "1" is entered, drive DIATOM::LDB1 will be mounted. If "2" is entered, both drives DIATOM::LDB0 and DIATOM::LDB1 will be mounted. Any SONY drive mounted will be dismounted automatically when the program terminates.

(7) CORNERS represents two corners for the output image, in device (pixel,line) coordinates. A rectangle defined by the projection of these two points in pixel/line space will be the portion of the display containing the output image. This parameter can be changed dynamically.

**DYNAMIC PARAMETERS:**
After the previous parameters have been selected and "RUN" has been entered, the user may be prompted for more parameters depending upon the choices made and/or IIS buttons depressed. The list of these parameters along with their definitions are given below except where they duplicate the above list.

(1) CDBREAK are the wind magnitude break points for drag coefficients, to be used for stress computations. If the null value is kept, a constant drag coefficient (specified in DRAG(1)) is used. Otherwise, either one or two values are input for CDBREAK, and two or three values respectively should be entered for DRAG. The values for CDBREAK should be greater than 0 (0 is automatically defined as a break point). The values for DRAG will be applied inclusive of each break point in CDBREAK.

(2) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(3) CORNERS represents two corners for the output image, in device (pixel,line) coordinates. A rectangle defined by the projection of these two points in pixel/line space will be the

portion of the display containing the output image. This parameter can be changed dynamically.

(4) DRAG are the drag coefficient values, to be used for stress computations, when METHOD=2 is specified. Each drag coefficient in sequence will be applied to stress computations for wind magnitudes within the corresponding range defined by the entries of CDBREAK. If the null value is kept for CDBREAK, the value of DRAG(1) is used as the constant drag coefficient.

(5) EASTLONG is the easternmost longitude for the output image. Valid longitude limits for the data sets are:

CDF's: dataset-dependent
NORDA: -180 to 180

(6) INTERP specifies the interpolation method to use in creating the image from the data sets. A "1" should be entered for a bi-linear interpolation, this is the fastest method. A "2" causes the bi-cubic spline to be used, this requires much more time.

(7) LANDGRY is the gray level value to use for land and must be in the range 0 to 255.

(8) LEVEL is the CDF level value of type LEVTYP and must be entered if a LEVTYP other than "NONE" is indicated. The units correspond to the LEVTYP, and will typically be in meters (for depth or height) or millibars (for atmospheric pressure)

(9) LEVTYP is the CDF level type mnemonic and must be specified if applicable. One should enter "NONE" when there is no level information in the CDF (i.e. only data at one level). When multi-level data is present in the dataset, specifying LEVTYP="NONE" will extract only the first level (i.e. whatever level is in the first element of the level array).

(10) MAX_DATA is the maximum data value to display. Note that values greater than or equal to MAX_DATA will all have gray level values of MAX_GREY. Typical data units are as follows:

1. Temperature: degrees C
2. U,V,W wind components, vector wind, Ekman upwelling: m/sec
3. Relative humidity: %
4. Geopotential heights: m
5. Surface stress: Newtons/m**2
6. Ekman transport: m**2/sec
7. Divergence, curl: 1/sec
8. Atmospheric pressure: mb
9. NORDA bathymetry: m

(11) MAX_GREY is the gray level value to display for MAX_DATA and must be in the range 0 to 255.

(12) METHOD is the drag coefficient computation method. This is used for computations using surface stress, including Ekman transport, Ekman upwelling, wind stress curl, and northward

Sverdrup transport. METHOD=1 uses the following formulation taken from Large and Pond (1981),

```
Drag = 1.14 * 10**-3 , ¦ U at 10 m ¦ < 10 m/s
Drag = 10**-3 * (0.49 + 0.065 * ¦ U at 10 m ¦),
     ¦ U at 10 m ¦ > 10 m/s
```

Method 2 uses linear drag coefficient segments, where the wind magnitude break points are specified in CDBREAK and drag coefficients for ranges between the beaks are specified in DRAG.

(13) MIN_DATA is the minimum data value to display. Note that values below MIN_DATA will all have gray level values of MIN_GREY. Values at MIN_DATA will also have values of MIN_GREY, <u>except</u> for values of 0 with data type NORDA which are treated as land values and will have a gray shade LANDGRY. The data units are given under parameter MAX_DATA.

(14) MIN_GREY is the gray level value to display for MIN_DATA and must be in the range 0 to 255.

(15) NORTHLAT is the northernmost latitude for the output image. Valid latitude limits for the data sets are:

CDF's: dataset-dependent
NORDA: -80 to 90

(16) PARAM is the mnemonic(s) of the CDF variable to be used in the plotting. To obtain a list of mnemonics of a particular CDF, one should run the program CDFLST. Up to four values for PARAM may be entered. When a raw quantity is desired, specify this in PARAM(1). When a diagnostic quantity is desired, specify the diagnostic mnemonic in PARAM(1), u wind mnemonic in PARAM(2), v wind mnemonic in PARAM(3), and height field mnemonic (if needed for geostrophic computations) in PARAM(4). Possible values of PARAM(1) for diagnostic computations are:

WINDV = total wind vector
WINDGV = geostrophic wind vector
TAUV = surface stress vector, using raw winds
TAUGV = surface stress vector, using geostrophic wind
EKMV = Ekman transport vector, using raw winds
EKMGV = Ekman transport vector, using geostrophic wind
DIV = divergence (1/sec) of raw wind
CURL = vertical component of curl, vorticity (1/sec) of raw wind
DIVG = divergence (1/sec) of geostrophic wind
CURLG = vertical component of curl, vorticity (1/sec) of geos. wind
TAU = total surface stress (N/m**2)
TAUX = E-W surface stress (N/m**2)
TAUY = N-S surface stress (N/m**2)
TAUG = total surface stress (N/m**2) - based on geostrophic winds

TAUGX = E-W surface stress (N/m**2) - based on geostrophic winds
TAUGY = N-S surface stress (N/m**2) - based on geostrophic winds
TAU3 = total surface stress to the 1.5 power (N**1.5/m**3)
TAUG3 = total surface stress ** 1.5 (N**1.5/m**3) - based on geostrophic winds
EKM = total surface Ekman transport (m**2/s)
EKMX = E-W surface Ekman transport (m**2/s)
EKMY = N-S surface Ekman transport (m**2/s)
EKMG = total surface Ekman transport (m**2/s) - based on geostrophic winds
EKMGX = E-W surface Ekman transport (m**2/s) - based on geostrophic. winds
EKMGY = N-S surface Ekman transport (m**2/s) - based on geostrophic winds
EKMD = Ekman depth (m)
UPWEL = Ekman upwelling - based on raw winds (m/s)
UPWELG = Ekman upwelling - based on geostrophic winds (m/s)
WIND = raw wind speed contours (m/s)
WINDG = geostrophic wind speed contours (m/s)
WDDIR = raw wind direction, 0 to 360 degrees
CRLT = curl of total surface stress - based on raw winds (kg/(m**2 * s**2))
CRLTG = curl of total surface stress - based on geostrophic winds (kg/(m**2 * s**2))
NSVT = northward Sverdrup transport - based on raw winds (kg/(m*s))
NSVTG = northward Sverdrup transport - based on geostrophic winds (kg/(m*s))

(17) SOUTHLAT is the southernmost latitude for the output image. The valid latitude limits for the data sets are given under the parameter NORTHLAT.

(18) TYPE is the component type for stress-related fields. If a value of "1" is entered, the second and third values for parameter PARAM are assumed to be zonal and meridional components of stress, which are present in the requested CDF. Other quantities such as Ekman upwelling and transport could then be derived directly from the stress components. If a value of "2" is entered, the second and third values for PARAM are assumed to be raw surface wind components. In this case, no cyclonic rotation or decrease in magnitude will be applied to the resultant stress vector. If a value of "3" is entered, the second and third values for PARAM are assumed to be geostrophic wind components. In this case, the resultant stress vector will be rotated cyclonically by 15 degrees and decreased in magnitude by 30% to extrapolate it to a surface value.

(19) WESTLONG is the westernmost longitude for the output image. The valid longitude limits for the data sets are given under the parameter EASTLONG.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Create Image With Current Settings | Save Current Channel To Disk | | Turn Graphics Plane On/Off | Exit |
| 2 | Read Gray Level, Data Lat/Lon At Cursor | Display Grid Values And Statistics | | | Change Data Type, Times, Increment |
| 1 | Change Data or Gray Max or Min, Interpolation or Img size | Change Lat/Lon Limits | Change Method For Lat/Lon Selection | | Change Channel |

A1: This button gives the user the capability to change the minimum/maximum data values (MIN_DATA, MAX_DATA), the minimum/maximum gray level values (MIN_GREY, MAX_GREY) the method of interpolation used to generate the image (INTERP), the default image output size and location (CORNERS), or the gray value to be assigned to land (LANDGRY).

A2: Several items at the cursor location can be read using this button. These are the pixel/line location, the latitude/longitude, the gray scale value and the data in physical units.

A3: The image with the current or prompted settings will be generated using this button.

B1: This button allows the user to type in the latitude/longitude limits (EASTLONG, WESTLONG, NORTHLAT and SOUTHLAT) or set the latitude/longitude box size to overlay on the "overview" image when selecting the region of interest. In the case when the box method is used, i.e. MODE = 2, the program CURBOX is called by this button. The parameters and button menu associated with that program can be found in that section of the report. Exiting from the program CURBOX returns the user to ENVIMG. Mode 2 may have been selected either from input or using button C1 to toggle into this mode.

B2: The data values at the grid points and the associated statistics are output by this button. The user is prompted with the parameter DEST and should enter a "T" for terminal output, a "P" for printer output, and an "F" for file output. Up to three choices for DEST can be entered at one time. FILENAME is the name of the output file which will be generated when DEST includes an "F".

B3: This button allows the user to save to disk the image currently displayed. One will be prompted for the FILENAME under which to save it.

C1: This button acts as a toggle to allow the user to input latitude/longitude directly as values or with a box overlayed on the "overview" image. The button B1 can then be used to change or define new latitude/longitude limits.

D3: Selected graphics planes can be toggled on/off or erased by this button. The user is prompted with the parameters PLANES and ONOFF. PLANES is a list of up to 7 graphics planes to be turned on, off or erased. ONOFF specifies the action to be performed for each plane. A "0" turns the plane off (disables it); a "1" turns it on (enables it); a "2" erases the plane (clears it).

F1: The IIS channel can be changed with this button which calls the program SELECT. The user is prompted for the parameter CHANNEL which is the IIS channel to be viewed.

F2: The data type (DATTYP), times (DATE) and time increment (INCREM) can be changed using this button.

F3: This button terminates the current program.

**PROGRAM NAME:** ENVQRY
**DATE:** 4/15/91
**MENU:** ENVIROLIST

**DESCRIPTION:** This program will print a group of filenames containing specific environmental data parameters to the system printer, a file in the user's current directory, and/or the terminal screen. This information is useful for running the various SEAPAK environmental (hydrographic, meteorological or oceanographic) data listing, plotting and imaging programs, which often prompt for these filenames. The listings for each parameter include the file names as well as their location on disk, and SEAPAK programs supporting the user of these files. The user can also print a complete list of the supported environmental parameters to the system printer.

**PARAMETERS:**

(1) PARAM is a list of up to 50 environmental data parameters for which information is requested, specified by their numbers from the following list. The parameter is nullable only for the case where only a print of the parameter list is requested with LSTPAR="Y".

HYDROGRAPHIC/OCEANOGRAPHIC PARAMETERS:

River discharge:

1 = annual average flowrate
2 = drainage area
3 = Julian day of maximum flow
4 = minimum daily flowrate
5 = maximum daily flowrate
6 = monthly average flowrate

Oceanic temperature/stratification-related

7 = depth of the 11 degrees C isotherm
8 = depth of the 12 degrees C isotherm
9 = depth of the 13 degrees C isotherm
10 = depth of the 14 degrees C isotherm
11 = depth of the 15 degrees C isotherm
12 = depth of the 16 degrees C isotherm
13 = depth of the 17.5 degrees C isotherm
14 = depth of the 20 degrees C isotherm
15 = depth of the 22.5 degrees C isotherm
16 = depth of the 25 degrees C isotherm
17 = mean temperature, surface to 300 meters
18 = mean temperature, surface to 400 meters
19 = mixed layer depth
20 = mixed layer temperature

21 = ocean (sub-surface) temperature
22 = sea surface temperature
23 = sigma-t
24 = depth of the thermocline

<u>Oceanic</u> - <u>nutrients/chemical</u> <u>properties</u>

25 = dissolved oxygen
26 = saturation dissolved oxygen
27 = inorganic phosphorus
28 = total phosphorus
29 = nitrate
30 = nitrite
31 = salinity
32 = silicate
33 = pH
34 = phosphate
35 = water pressure
36 = chlorophyll/pigment

<u>Oceanic</u> - <u>currents</u>

37 = zonal ocean current speed
38 = meridional ocean current speed
39 = meridional ocean current accleration
40 = zonal ocean current acceleration
41 = Sverdrup transport
42 = zonal ocean current variance
43 = meridional ocean current variance

<u>Oceanic</u> - <u>physical properties</u>

44 = sound speed
45 = specific volume
46 = potential density
47 = water transparency
48 = sea height

<u>Oceanic</u> - <u>interface</u> <u>to</u> <u>land/sea</u>

49 = bathymetry
50 = land-sea flag
51 = land-ice flag
52 = sea-ice concentration

METEOROLOGICAL PARAMETERS:

<u>Thermodynamic</u> <u>parameters</u>

53 = air-sea temperature diff.
54 = Newtonian cooling
55 = cloud coverage

56 = precipitation amount
57 = relative humidity
58 = specific humidity
59 = specific humidity minus saturation specific humidity
60 = air temperature
61 = wind speed times air-sea temperature difference
62 = evaporation parameter
63 = dewpoint temperature

Flux-related parameters

64 = incoming shortwave radiation
65 = buoyancy flux
66 = latent heat transfer coefficient
67 = latent heat flux
68 = net radiation budget
69 = outgoing longwave radiation
70 = sensible heat flux
71 = meridional latent heat flux
72 = zonal latent heat flux
73 = meridional sensible heat flux
74 = zonal sensible heat flux
75 = net freshwater flux
76 = net energy flux

Wind-related parameters

77 = friction velocity
78 = zonal wind stress
79 = meridional wind stress
80 = wind stress
81 = wind stress curl
82 = zonal wind speed
83 = meridional wind speed
84 = scalar wind speed
85 = standard deviation of wind speed
86 = wind direction
87 = uprime * vprime

Other parameters

88 = geopotential height
89 = pressure
90 = ozone
91 = eddy kinetic energy

(2) OUTPUT is a list of the output destinations for the detailed output on each requested parameter. Up to three values may be specified, from the possible values "T" (output to terminal), "P" (output to system printer) or "F" (output to a file, named (parameter).FILES, in the user's default directory). OUTPUT

is nullable only for the case where a list of the environmental data parameters is requested by specifying LSTPAR="Y".

(3) LSTPAR is a flag indicating whether a complete list of the supported environmental data parameters should be sent to the system printer. Possible values are "Y" (i.e. send list, to be called ENVQRY.PRMLST, to the printer) or "N" (i.e. do not send list to the printer).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** EOF
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This program generates the Empirical Orthogonal Functions (EOFs) and the time coefficients (principal components) of a sample covariance matrix. A detailed description of the procedure is given in NASA Technical Memorandum 83916 (Murray et al., 1984).

Three types of output files may be generated (see OUTNAME): the EOF files, the time-average file, and an ASCII file containing the eigenvalues, eigenvectors and principal components of the covariance matrix. The EOF and time-average files binary, real-valued image files that may be input to STATDIS to create regular SEAPAK image files. The program EOFPLOT may be used to plot the principal components contained in the ASCII file.

**INPUT PARAMETERS:**

(1) INFILS are the names of a series of image files to process for the EOF analysis. The image file names may contain wild card characters ("*" to substitute for any number of characters and "%" for only one character). Up to 36 file names may be specified. If the list of names is longer, or simply for convenience, the name of one ASCII file containing such a list may be specified instead. In this ASCII file, the names (with possible wild cards) of the image files should be specified one name per line. (Of course, the list file name itself must not contain wild cards.) The extension ".IMG" will be used by default if it is omitted from an image name, whereas ".LST" will be used by default for a list file name. The names must be valid host file names.

Example (image name with wild cards):
    "IM*GENA%E" ==> "SCRATCH:[acctname]IM*GENA%E.IMG"

Example (list file name):
    "LISTNA%E" ==> "SCRATCH:[acctname]LISTNAME.LST"

(2) OUTNAME is the name to be used for naming all output files. Three types of output files may be generated: the EOF files, the time-average file, and an ASCII file containing the eigenvalues, eigenvectors and principal components of the covariance matrix. The EOF and time-average binary files, real-valued image files that may be input to STATDIS to create regular SEAPAK image files. The program EOFPLOT may be used to plot the principal components contained in the ASCII file. The number of EOF generated files may be specified by N_OUT. For the EOF files, the extension ".DAT" will be used by default if it is omitted. For example, if N_OUT = 3 and OUTNAME = "EOFOUTPUT", the files created will be named as follows:

```
SCRATCH:[acctname]EOFOUTPUT1.DAT  \
SCRATCH:[acctname]EOFOUTPUT2.DAT   > N_OUT EOF binary files
SCRATCH:[acctname]EOFOUTPUT3.DAT  /
SCRATCH:[acctname]EOFOUTPUT.AVG  - time-average binary file
SCRATCH:[acctname]EOFOUTPUT.EIG   -  eigenvalues, eigenvec-
               tors, and principal components ASCII file
```

(3) N_OUT is the number of EOF files to generate. The number requested cannot be greater than the number of input image files (but may be zero).

(4) BLOTCH: If GPLANE is not 0, enter the name of the blotch file which defines the image area(s) of interest. Only blotches defined on the plane corresponding to GPLANE will be used. (Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV.) This file will also need to be specified as input to STATDIS when using that program to examine the EOF and time-average files generated. If GPLANE = 0, indicating that the full image areas are to be processed, BLOTCH will be ignored. The extension ".BLO" will be used by default if it is omitted from the file name.

(5) GPLANE Enter the number (1-7) of the graphics plane containing the blotch area(s) of interest. If the number is positive, pixels within the blotch will be considered; if the number is negative, pixels outside the blotch will be considered. Only blotches defined on this plane (the absolute value of GPLANE) of the blotch file BLOTCH will be used. (Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV.) However, if 0 is entered, the entire image area (512 x 512) will be used and BLOTCH will be ignored.

(6) MODE: Enter 1 (the default value) if the pixel values of the image(s) specified by INFILES represent data (such as temperature) that are linearly related to gray levels (see help text for FACTOR); enter 2 if they represent pigment concentrations (mg/m3).

(7) FACTOR: This parameter is used only if MODE = 1, implying a linear data-to-gray mapping function for the image(s) specified by INFILES; otherwise, it is ignored. If FACTOR is positive, it will represent the factor by which to divide the gray values of the image pixels in order to convert them into actual data values; if zero is entered, the slope and intercept for this mapping function will be obtained from each file header of the disk image files.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** EOFPLOT
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc generates the EOF temporal function plot on the IIS display monitor or HP 7550 plotter. The input file which stores the temporal function (or so called principal components) are generated by the proc EOF and have a file name with the extension of .EIG . To obtain the plot, one specifies: 1) the file containing the temporal eigenvectors, 2) which principal component (un-normalized eigenvector) to plot, and 3) the graphics plane to use. The graph generated is then the amplitude of each element of the specific principal component versus the number of the element in this vector array, i.e. the time dimension of the vector. For example, if 10 scenes in a time series are used in the program EOF to generate the temporal eigenvectors, each of these eigenvectors will have 10 elements, i.e. a dimension of 10. The plot will then be the magnitude of the element versus the element number (1 through 10) for the selected eigenvector.

**PARAMETERS:**
(1) INFIL is the input EOF time function file name. The file should be generated by the proc EOF and have a name with an extension of .EIG (the default extension).
(2) COMP specifies the number of the temporal eigenvector to plot. The number entered should fall in the range of 1 to the total number of images generated in the proc EOF.
(3) GPLANE is the graphics plane to use for the plot.

**DYNAMIC PARAMETERS:**
After the previous parameters have been selected and "RUN" entered, the user is prompted for one more parameter.
(1) DEVICE is the output device for the EOF temporal function plot. One should enter "II" to plot on the IIS or "HP" to plot on the HP 7550. For "HP", the pen number corresponding to the value of GPLANE will be used.

**IIS BUTTON DEFINITIONS:**
No buttons are required in the execution of this program.

**PROGRAM NAME:** EPSILON
**DATE:** 4/15/91
**MENU:** L2PROD

**DESCRIPTION:** EPSILON creates images of the epsilon values for the 443, 520, 550 and 670 nm channels of the CZCS. Epsilon values are related to the Angstrom exponents used by the level-2 programs (e.g. L2MULT) in the computation of the aerosol radiances for each channel (Gordon et al., 1983). Implicit in the computation of the epsilons is the assumption that pixels which pass the cloud, solar zenith angle, and scanner zenith angle thresholds are clear-water pixels. This means that clear-water radiances are assumed (Gordon and Clark, 1981).

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root name for the four epsilon image files that are created. A digit 1 to 4 will be inserted prior to the period of the extension to designate the files corresponding to channels 1 to 4, respectively. The extension ".IMG" will be used by default if it is omitted from the name. In addition, a text file with an OUTFILE root name and a "L2P" extension is created which contains all the important constants and parameters used in processing the data.

(3) EPS are two epsilon values indicating the limits of values to consider as valid. These values are used to set the gray level scaling of the output images. Epsilon values which fall outside this range are assigned a gray level value of 0 (black); values within the range are scaled to gray levels between 1 to 255.

(4) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(5) CORR is the index of the correction method to use for calculating total radiances:
1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
2: Use correction factors specified by FACTOR.

(6) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(7) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three

dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

(8) LANCLD is the channel 5 threshold in gray-level value used to identify land and clouds. All pixels with values exceeding this value are flagged and assigned a value of 0 (black).

(9) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(10) SUN is the solar zenith angle threshold used to avoid pixels with large atmospheric path radiances. Pixels for which this angle is greater than SUN are assigned a value of 0 (black).

(11) SCAN is the scanner zenith angle threshold used to avoid pixels with large atmospheric path radiances. Pixels for which this angle is greater than SCAN are assigned a value of 0 (black).

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** FADE
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** The proc FADE is an interactive frame fading utility developed for the IIS Model 75. It operates on the frames individually or together, either frame being a 1, 2, or 3 band image. When one moves the cursor right, frame #1 fades. When one moves the cursor left, frame #2 fades.

**PARAMETERS:**

(1) FR1BDS specifies the number of bands or memories used for the first frame. This parameter accepts a number between 1 and 3 inclusive. Examples for the input are:

| | |
|---|---|
| FR1BDS = 1 | monochrome image |
| FR1BDS = 2 | stereo image |
| FR1BDS = 3 | 3-band false/true color image |

(2) FR1CHNS is the parameter which identifies the number(s) of the refresh memory(ies) for the first frame being faded. The numbers must be in the following order: 1) 3-band -- red, green, blue; 2) stereo -- red, blue- green. The acceptable values are numbers between 1 and 14 inclusive. For example,

```
FR1BDS = 3
FR1CHNS = (4,6,7)
```

In this example, frame #1 is a 3-band image which has its red band in refresh memory 4, green band in refresh memory 6, and blue band in refresh memory 7.

(3) FR2BDS is the number of bands or memories used for the second frame. As with FR1BDS, FR2BDS also requires a number between 1 and 3 inclusive.

(4) FR2CHNS is the parameter which identifies the number(s) of the refresh memory(ies) for the second frame being faded. As with FR1CHNS, the numbers must be in the following order: 1) 3-band -- red, green, blue; 2) stereo -- red, blue-green. Again, the acceptable values are numbers between 1 and 12 inclusive. For example,

```
FR2BDS = 2
FR2CHNS = (1,10)
```

In this example, frame #2 is a 2-band stereo image which has its red band in refresh memory 1, and its blue-green band in refresh memory 10.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Fade Frames #1 & #2 | Fade Frame #1 | Fade Frame #2 | Change Frames | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button allows one to fade between both frames. Moving the cursor to the right fades frame #1; moving the cursor to the left fades frame #2.

B3: This button allows one to fade only frame #1 without altering frame #2. Movement of the cursor to the right causes the frame to fade whereas movement to the left restores it.

C3: This button allows one to fade only frame #2 without altering frame #1. Movement of the cursor to the left causes the frame to fade whereas movement to the right restores it.

D3: One may change frames by depressing this button. The program requests as input all four of the above parameters. The original values are the defaults.

F3: To exit the program, one must depress this button.

**PROGRAM NAME:** FEED
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** This proc feeds the image currently displayed on IIS to the specified refresh memory(ies). The feed can take place with a gray scale image or a colored image. For an image with a color LUT loaded, the red, green or blue outputs can be fed separately to different refresh memories. This proc is necessary to save an image whose LUT has been modified (stretched, etc.) or which has been modified in some way by the IIS hardware. One example where this program would be used is if one had just registered an image using REGIST. To save this registered scene, one must first FEED it to another IIS memory and then save it using TODISK.

**PARAMETERS:**

(1) CHAN identifies to which channel(s) the image(s) is(are) being fed. Enter three refresh memory numbers if you intend to feed a three band image. These images are stored in the order of red, green and blue bands. Enter one refresh memory number if you intend to feed a single band image. If the single band image is somehow pseudo-colored, the feed will take place for the color specified by RGB along with its LUT. Therefore, if you intend to feed the original image instead of the colored image, one must reset the LUT's to the linear gray scale (use LUTMOD or LUTLOAD) before feeding. A knowledge of the IIS system becomes more important if one wants to save pseudo-colored images.

(2) RGB indicates which "gun", red, green or blue, is to be fed to the output channel, CHAN. Enter a value of 0 if you intend to use the blue gun to feed the image to CHAN. Enter a value of 1 if you intend to use the green gun or a value of 2 if you intend to use the red gun to feed the image. This parameter is valid only if you specify one output refresh memory number for parameter CHAN.

(3) BLOTCH defines a blotch plane number which one may use to define a region for the FEED. If a blotch plane is not being used, enter 0. To use the exterior of the blotched region, enter a negative number. Enter a positive number in order to use the interior of the blotched region.

(4) MINCLP can be used to modify the range of the output values when feeding to CHAN. All the pixels in the input image with values less than MINCLP are set to the minimum value, OUTMIN, in the output channel.

(5) MAXCLP is also used to define the range of the output values when feeding to CHAN. All the pixels in the input image with values greater than MAXCLP are set to the maximum value OUTMAX in the output image. These values are in the range 0 to 255.

(6) OUTMIN defines the minimum output value. These values are in the range 0 to 255.

(7) OUTMAX defines the maximum output value. These values are in the range 0 to 255.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** FILLA
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** This proc allows you to replace pixel values with certain other values determined by the OPTION selection:

1. Image pixels within a blotch are replaced by a constant.
2. "Invalid" image pixels within a blotch are replaced by the mean of surrounding "valid" pixels.
3. "Invalid" image pixels within a blotch are replaced by random values based on the mean and standard deviation of surrounding "valid" pixels.
4. Images pixels within a blotch are replaced (filtered) by the mean of surrounding pixels.

The parameters WINDOW and NVALID are used to determined the definition of "surrounding;" RANGE is used to determine the "validity" of a pixel value; and BLOTCH and GPLANE specify the "blotch" area of the image to process.

**PARAMETERS:**

(1) INFILE is the name of the disk image file to process. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the name of the disk image file to create and in which to store the processed input image. The extension ".IMG" will be used by default if it is omitted from the file name.

(3) BLOTCH is the name of a disk file from which to use the graphics plane(s) specified by GPLANES. The extension ".BLO" will be used by default if it is omitted from the file name.

(4) GPLANE: Enter up to seven values for the graphics plane numbers (1 to 7) to use for specifying the blotch areas to process. The number of GPLANE values specified must match the number of RANGE value pairs specified. Only pixels found to be outside a given range (i.e., "invalid") and which are within the blotch area of the corresponding GPLANE will have their values replaced.

Note that, for OPTION = 2, 3, or 4, the RANGE value pairs are used to determine which of the surrounding pixels are valid for inclusion in the calculation of a pixel replacement value. Therefore, if a pixel is located within the blotches of more than one GPLANE, its replacement value in such a case will be based on the surrounding pixels as determined by the last RANGE value pair that is specified.

(5) OPTION: Enter 1, 2, 3, or 4 to specify any of the following options for replacing INFILE image pixel values.

1. Pixels within a blotch of a specific GPLANE, and whose values are outside the RANGE pair corresponding to that GPLANE, will be replaced by the value of CONST.
2. Pixels within a blotch of a specific GPLANE, and whose values are outside the RANGE pair corresponding to that GPLANE, will be replaced by the mean of the surrounding pixels. The surrounding pixels are those that are within a square window centered on the pixels to be replaced (see WINDOW). If NVALID valid pixel values (as defined by the same RANGE pair) are not found in this window (and NVALID>0), the window size will be increased until this condition is met. Note that the mean is calculated in data units as specified by MODE.
3. Pixels within a blotch of a specific GPLANE, and whose values are outside the corresponding RANGE, will be replaced by a random value based on the mean (X) and standard deviation (S) of the surrounding pixels. Those pixels are determined by WINDOW and NVALID as for OPTION=2. However, X and S are calculated using the gray levels of the surrounding pixels regardless of MODE. This is because the random values are generated from a Gaussian distribution (of X and S) and such a distribution matches more closely that of the gray values than that of pigment data. To exclude outliers as replacement values, random values that are outside bounds are not used; the corresponding lower or upper bound on the side of the outlier is used instead. The bounds are X-S or the minimum of the surrounding pixels and X+S or the maximum of the surrounding pixels, whichever are closer to the mean. (The min/max values may be within one S of X because of the skewness of the surrounding pixels' distribution.) Because outliers are rejected, the S of the actual replacement values will be somewhat smaller than that of the surrounding pixels.
4. Pixel values of pixels within the blotch area specified by any GPLANE graphics plane will be replaced by the mean value of surrounding pixels. The surrounding pixels are defined by WINDOW and NVALID as for OPTION=2, except that, if NVALID valid values are not found, the pixel value is not replaced (i.e., the window is not expanded). Note that, as for OPTION=2, the mean is calculated in data units as specified by MODE.

Note that, for OPTION = 2, 3, or 4, the RANGE value pairs are used to determine which of the surrounding pixels are valid for inclusion in the calculation of a pixel replacement value. Therefore, if a pixel is located within the blotches of more than one GPLANE, its replacement value in such a case will be based on the surrounding pixels as determined by the last RANGE value pair that is specified.

(6) MODE: Enter 1 to indicate a data type that is linearly related to the gray levels or 2 to indicate pigment concen-

tration values. When MODE=1, FACTOR is used to determine the linear data scale.

MODE is used to specify the data type the replacement calculations of OPTION = 1, 2, and 4, and to specify the units of values entered for CONST (when OPTION=1) or RANGE (when OPTION = 2, 3, or 4). It should match the type of the data in the INFILE image.

(7) WINDOW is the width (in pixels) of a square (window) to use for determining the surrounding pixels when OPTION = 2, 3, or 4. The window will be centered over each pixel to be replaced. The RANGE value pairs are then used to determine which of these pixels have "valid" values to include in the calculation of the replacement value. For OPTION = 2 or 3, if NVALID such pixels are not found and NVALID>0, the window width (and length) is automatically widened (lengthened) by one pixel at each end until the criterion is met. For OPTION=4, if NVALID such pixels are not found, the center pixel is not changed.

Note that, as a result, the replacement value of a pixel that is located within the blotches of more than one GPLANE will be based on the surrounding pixels as determined by the last RANGE value pair that is specified.

(8) NVALID is the minimum number of "valid" pixel values needed in the surrounding window for calculating replacement values for OPTION = 2, 3, or 4. (See help text for WINDOW.) The RANGE value pairs are used to determine the validity of the window pixels. For OPTION = 2 or 3, if NVALID such pixels are not found, the window width is automatically incremented by one until the criterion is met. However, if NVALID=0, the window is not enlarged (since in fact the criterion is always met) and the center pixel is not replaced if the window contains no valid pixels. For OPTION=4, if NVALID such pixels are not found, the center pixel is not changed.

(9) RANGE must be specified as pairs of values, each pair having a one-to-one correspondence with the specified GPLANE values. Each pair represents the minimum and maximum valid pixel values. The RANGE values must be in the units specified by MODE and FACTOR (if MODE=1).

NOTE: For OPTION = 1, in order to specify that all pixels within a GPLANE blotch are to be replaced (i.e., are "invalid"), simply set the minimum value to be greater than the maximum for the corresponding RANGE.

For OPTION = 2 or 3, pixels within a blotch of a specific GPLANE, and whose values are outside the corresponding RANGE pair, will be replaced. For OPTION = 2, 3, or 4, RANGE is also used to determine which of the surrounding pixels are valid for inclusion in the calculation of the replacement value for a pixel within the blotch of the corresponding GPLANE. Therefore, if a pixel is located within the blotches of more than one GPLANE, its replacement value will be based on the surrounding pixels as determined by the last RANGE value pair that is specified.

(10) FACTOR is used only if MODE=1, implying a linear data-to-gray mapping function; otherwise, it is ignored. FACTOR represents the factor by which to multiply any CONST or RANGE values in order to obtain their gray-level equivalents.

To specify gray values for CONST and RANGE, enter 1 (default); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 100.

(11) CONST is the value by which to replace image pixels within the blotches of any GPLANE graphics plane. The value must be in the units specified by MODE and FACTOR (if MODE=1).

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** FILLM
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** This proc provides button functions for replacing (filling) pixel values which are considered invalid. These may include land, cloud, or drop-out pixels. The valid values are defined by a specified range (button D1). A blotch is used to indicate the image area in which to replace invalid pixels (button F2). The replacement values may be a constant (button C1) or random values (button A1). The random values are generated from a distribution based on the mean and standard deviation of valid pixels found within another blotch specified for that purpose (button F1). (See the help text for the parameter RANGE of button D1 for more detailed information about the random number replacement method.)

**PARAMETERS:**

(1) CHAN is the display channel number (1-14) for the image to be processed.

(2) OUTCHN is the channel number (1-14) where the output image is to be displayed. A different value from the input channel number CHAN should be entered.

(3) MODE is used to specify the data type of the constant and range values specified via buttons C1 and D1, respectively. MODE=1 indicates gray levels whereas MODE=2 indicates pigment concentrations.

Note that the means and standard deviations are calculated using the gray pixel levels regardless of the value of MODE. See the help text for the parameter RANGE of button D1 for additional information.

(4) GPLANE are two integer values in the range of (1-7) to define the blotching graphics planes. The first graphics plane is used to define the blotching for the statistics distribution. The second graphics plane is used to define the blotch for the estimation fill processing. Both graphics planes can be easily redefined via button menu instructions once the current PROC is initialized. The blotching can be done either in the current PROC or in the PROC BLOTCH.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick new vertex | Delete last vertex | Close region | Erase blotch | Exit |
| 2 | Start new plane | Blank plane | Blotch exterior of region | On/off plane | Define blotch for filling/ restore |
| 1 | Process the filling | Restore from input image | Fill with constant | Define range for filling | Define blotch for mean/ variance |

A1: This button allows the user to fill the area selected by button F2. The filling will use the statistics of the area defined by F1, and will affect only those points outside the range given by D1.

A2: This button allows the user to select a new graphics plane in which to define a blotch polygon. The plane is automatically incremented when this button is depressed and the new plane number is displayed on the terminal.

A3: This button allows one to select a new vertex for a blotch being defined. After the first vertex has been selected, it also causes a line to be drawn connecting the previous vertex to the presently selected one.

B1: If one does not like the filling that has been done, this button will allow the user to restore the data from the original image. A new constant, region for statistics, or range can now be defined.

B2: The current graphics plane can be totally erased with this button. Note that when this button is used in conjunction with A2, you are allowed to erase any previously generated plane.

B3: This button will delete the last vertex created using A3.

C1: This button allows one to fill the points defined by F2 and D1 with a selected constant value.

1) CONST is the value by which to replace image pixels within the blotch defined for processing. Pixel values outside the specified range (button D1) will be replaced. (NOTE: To specify that all pixels within a blotch be replaced, simply set the range minimum value to be greater than the range maximum.) CONST must be a gray level or a pigment concentration as specified by MODE.

C2: Depressing this button causes the region exterior to the defined polygon to be filled after the polygon has first been closed by connecting the first and last vertices.

C3: Pushing this button causes the interior of the defined polygon to be filled after the polygon is first closed by connecting the first vertex with the last.

D1: This button allows one to define a range to exclude from the filling process.

1) RANGE are two values representing the minimum and maximum valid pixel values, respectively. The RANGE values must be gray levels or pigment concentrations as specified by MODE.

For filling with a constant (button C1), pixels within the blotch defined for filling (button F2) whose values are outside this range (i.e., "invalid"), will be replaced. NOTE: In order to specify that all pixels within the blotch be replaced, simply set the first RANGE value to be greater than the second.

For filling with random values (button A1), pixels within the blotch defined for filling whose values are invalid will be replaced. The random values are obtained based on the mean (X) and standard deviation (S) of the valid pixels in the blotch defined for mean/variance (button F1). Thus, in this case, RANGE is used to determine which values to use for the X and S calculations as well as to determine which values to replace. For this case, if the first RANGE value is greater than the second, no valid pixel values will be found in the blotch defined for mean/variance, and no pixel replacement (filling) will occur.

Note that X and S are calculated using the gray pixel levels regardless of the value of MODE. This is because the random values are generated from a Gaussian distribution (of X and S) and such a distribution matches more closely that of the gray values than that of the pigment data. To exclude outliers as replacement values, random values that are outside bounds are not used; the corresponding lower or upper bound on the side of the outlier is used instead. The bounds are X-S or the minimum of the pixels in the blotch defined for mean/variance and X+S or the maximum of those pixels, whichever are closer to the mean. (The min/max values may be within one S of X because of the skewness of those pixels' distribution.) Because outliers are rejected, the S of the actual replacement values will be somewhat smaller than that of the surrounding pixels.

D2: This button allows the user to turn the current graphics plane off (or on) to view the area under the blotch. This does not erase the plane as does B2.

D3: This button allows one to erase the current blotch. The lines that were used to determine the blotch are unaffected, i.e.

only the part that has been filled in is erased. Use button B2 to erase the entire plane.

F1: Depressing this button assigns the region under the blotch in the current graphics plane as the population for determining the statistical distribution used in filling. These statistics are then used to generate a random number for filling in the points defined by F2 and D1.

F2: Depressing this button assigns the region under the blotch in the current graphics plane as the region to be filled or restored.

F3: This button allows the user to exit from the program.

**PROGRAM NAME:** FIXLIN
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** FIXLIN is designed to correct line dropouts in an unmapped image. It does this by replacing the bad line with the same data from the line above or the line below, or with the average of the lines above and below. The image which has the line(s) which needs to be corrected is first displayed on the IIS by the proc IMAGE. The line which one wants to replace is then selected by the cursor. The button menu is then followed to select what data is used to replace the selected line. If the corrected image is to be saved, the proc TODISK must be used.

**PARAMETERS:**
No parameters are input. The button menu must be followed.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Duplicate Line Above | Duplicate Line Below | Fill with Above/Below Average | Restore Original Data | Exit |
| 2 | | | | | |
| 1 | Color the Cursor Black/White | Color the Cursor Red/Green | | | |

A1: Sets the cursor to black or white and toggles between these colors afterwards.
A3: Duplicates the line above onto the selected line.
B1: Sets the cursor to red or green and toggles between these colors afterwards.
B3: Duplicates the line below onto the selected line
C3: Replaces the selected line with the average of the lines above and below.
D3: Restores the original data to the last modified line.
F3: Exits FIXLIN and returns the user to SEAPAK.

**PROGRAM NAME:** FLAGLC
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This process flags land and clouds individually on an input CZCS image file. Two additional reference images are required, preferably the corresponding CZCS level 1 channel 5 image and the corresponding CZCS level 1 channel 1 image. One of the reference images (channel 5) provides information to identify water from land and clouds while the other reference image (channel 1) provides information to identify land from clouds. The output flagged image always has cloud flagged white and land flagged to a specified gray shade (usually dark).

NOTE: A similar proc named LANCLD which uses IIS image processing terminal to process land/clouds can also be used. The differences are as follows :

1. LANCLD needs an allocated IIS terminal.
2. LANCLD generates an output image on the display monitor which can be saved via TODISK proc while FLAGLC generates an output image file on disk.

**PARAMETERS:**

(1) CLOUD is an image file name which can be used as a reference to identify clouds from land. A CZCS level 1 channel 1 image is recommended for this purpose.

(2) LANCLD is an image file name which can be used as a reference to identify water from land and clouds. A CZCS level 1 channel 5 image is recommended for this purpose.

(3) IN is the file name of the input image to be flagged.

(4) OUT is the output image file name for the output land/cloud flagged image being generated.

(5) SHADE is a gray level value in the range of 0 to 255 which will be used in the output image to indicate land. Clouds are always white (the brightest, gray shade 255) in the output image.

(6) TRCLOUD is a value in the range of 0 to 255. This value is used in conjunction with the input cloud reference image to identify clouds from land. Any pixel in the cloud reference image file that has a gray value greater than the entered value is flagged as a cloud.

(7) TRLANCLD is a value in the range of 0 to 255. This value is used in conjunction with the input land/cloud reference image file to identify water from land/clouds. Any pixel in the land/cloud reference image file that has a gray value greater than the entered value is flagged as land/clouds.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** GEMGRD
**DATE:** 4/15/91
**MENU:** GEM4LIST

**DESCRIPTION:** This program is used to insert a GEMPAK4 missing data flag at locations in a grid falling over land, in order that contours generated from this grid do not extend over land areas, or to convert the grid to a Golden Software, Inc.'s spreadsheet format. The input grid is an ASCII file generated by GEMPAK4 program GDLIST. The output is another ASCII file with blanking over land areas, or a Surfer-compatible file. A blanked file can be loaded into the GEMPAK4 binary grid file using GEMPAK4 program GDEDIT for plotting. A Surfer-compatible file can be converted to a binary Surfer grid using its utilities. Wildcard filename inputs are supported as well (only one value, with the wildcard name, should be entered for INGRD). When wildcarding, OUTGRD will be given the name GDLISTB.FIL for an INGRD named GDLIST.FIL (when FUNC=1, i.e. blanking); OUTGRD will be named GDLISTS.GRD for an INGRD named GDLIST.FIL when FUNC=2 (creation of Surfer file) is used. Surfer expects a file type of .GRD when converting an ASCII file to a binary file.

**PARAMETERS:**
(1) INGRD are the names of GEMPAK4 ASCII grid files to be blanked. Either a single wildcard value, representing a group of files, or up to 50 individual filenames, can be specified. Note that the wildcard input must represent a maximum of 50 filenames.
(2) OUTGRD are the names of output ASCII grid files. The number of inputs must be either 0 (the null input, to be used when INGRD is a wildcard), or the same number as were input for INGRD. A null input will cause the output name to be appended by a "B" when FUNC=1 (i.e. GDLIST.FIL becomes GDLISTB.FIL) or appended by "S" and the filetype changed to .GRD when FUNC=2 (i.e. GDLIST.FIL becomes GDLISTS.GRD). Surfer expects a filetype of .GRD for ASCII to binary conversion done in its UTIL package.
(3) FUNC is the function to perform on INGRD file(s). Specify a value of 1 to blank and write GEMPAK4 ASCII grids, or a value of 2 to convert to PC-Surfer ASCII grids. Specify a single value of FUNC when INGRD(1) is wildcarded, to apply to all of the conversions. When not wildcarding a value of FUNC must be entered for each value of INGRD and OUTGRD.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** GEMPLOT
**DATE:** 4/15/91
**MENU:** GRIDANL

**DESCRIPTION:** This program allows the user to plot environmental data at resolutions of up to 512 latitudes by 512 longitudes. Specifically, it can be used for plotting such things as contours, streamlines or winds from NASA Climate Data System (NCDS) Common Data Format (CDF) files, ASCII files created by ASCENV, GEMPLOT, ENVIMG or CNVGRD programs, or contours of bathymetry from NORDA's Digital Bathymetry Data Base. Vectors can be drawn to represent the raw wind field, geostrophic winds derived from the height field, or diagnostic quantities such as Ekman transport or surface stress (both raw and geostrophic versions). Contours include raw fields, such as zonal or meridional winds or heights, or diagnostic fields like Ekman transport, surface stress, or Ekman upwelling. Data over land can be masked if the user wishes. Means over a specified time range as well as instantaneous fields can be generated. The user can save their keystrokes during a session and play them back (using programs TOHP or TOTEK). Data can be read from a SONY WORM drive if desired.

The plot output can be sent to either the IIS or a suitable graphics terminal such as a Tektronix (or an emulator such as a Color Trend), a VT240/241 or a Macintosh. The user specifies date, time and latitude/longitude limits for the plots, except when the output is to the IIS and an image is present in the refresh memory (in which case the header time and latitude/longitude form the basis for the data selection). The user can also choose the projection type (6 types are currently supported) and data type. Spatial and temporal limits, as well as data type and projection, can be varied during program execution.

In addition to contouring and streamlining, other capabilities include: creating political, regional or coastal boundary maps, drawing latitude/longitude or grid point overlays, changing image displayed or refresh channel, using SEAPAK annotation package, saving/restoring graphics to/from disk, changing line and color attributes during program execution, and writing default titles for plots.

The IIS version is button and tutor-driven, while the terminal version is tutor driven only. Note that when the output device is the IIS, Tek or Mac terminal, communication with the host system and graphical output can be kept at the same time and so the output can be generated one step at a time (on the Mac the user needs to toggle back to Tek 4014 emulation to see output). However, when the output goes to a VT240, graphics and text can not be seen simultaneously and so pieces of the output are decided upon at one time and drawn once at the end.

IMPORTANT NOTE: Aborting the program with CTRL-C is NOT recommended since this may hang subsequent runs of programs using GEMPAK or GEMPLT calls. If you do abort with CTRL-C and the program hangs,

you can run the SEAPAK program GPKILL to kill off the plotting subprocess before re-running GEMPLOT or any other GEMPAK/GEMPLT application. Rather than aborting, it is recommended that the program be exited normally, by typing the choice or hitting the button for EXIT.

**DATA AVAILABILITY:**
Since data is being collected continuously, the list of available data sets cannot be accurately reproduced here. A current list of all the available data sets can be found in the file, CDF$DAT: ENVDATA.LIST. Further information on the parameters etc. can be obtained using the program CDFLST.

**PARAMETERS:**

(1) MODE specifies the mode/output device for running the program. The allowable values are:

0 = IIS without an initial image being used for determining the date, time and latitude/longitude limits;

1 = IIS where an image will be displayed from within the program and used for determining the date, time and latitude/longitude limits (Note: The image which will be displayed must be a mapped image);

2 = VT240/241 or non-Macintosh Tek 4010/4014 emulation

3 = Tektronix 4105/emulation (except Macintosh)

4 = Macintosh with a Tek 4010/4014 emulation (such as Versaterm or Versaterm Pro)

5 = HP 7550 plotter

NOTES:
- Mac users should use mode 4 even if they have Tek emulation.
- Also note that graphics files generated from a particular device are not compatible with the other devices. For instance, you could not create graphics on the IIS, save to disk, and then display this on a Mac (or Tek, or VT240/241)
- Graphics on the VT240/241 will be monochrome (using Tek 4010/4014 emulation)
- Mac users: graphics will be produced in Tek 4014 mode and the user will then be returned quickly to VT100 mode. Graphics will not be erased from Tek 4014 mode and the user can access these by toggling the emulation setting in Versaterm (or Versaterm Pro).
- When using HP 7550 plotter, plotting instructions are accumulated in a file and will be sent to the plotter at the end.

(2) COLOR is a number associated with the starting color for the graphics (IIS, Tek only). For IIS, this is the same as the graphics plane number. For Tek or compatible, this is the

same as the color index (the index to color mapping depends on the current setup on the terminal - this can be changed interactively by the user at any time with the Menu key). For IIS, COLOR should be in the range 1 to 7, and for Tek, COLOR should be in the range 1 to 16.

(3) DATTYP defines the data type to be plotted. The possible responses are:

    CDF (Common Data Format from NSSDC)
    BATHY = NORDA bathymetry (m) - maximum of 240 longitudes x 135 latitudes
    ASCII = ASCII file input

**DYNAMIC PARAMETERS:**

Many parameters are interactively requested during the execution of this program. These are defined alphabetically in the following section unless they have already been defined in the PARAMETER section above.

(1) BOUNDS defines the type of boundary for the map requested. Allowable inputs are "PO" (political), "CO" (coastlines), and "RE" (regional). This parameter along with RESOL characterizes the map to be drawn. The program determines which map region to access depending on your latitude/longitude limits by choosing the smallest region meeting these limits (i.e. a quadrant will be chosen before a hemisphere and a hemispheric scale will be chosen before a world scale). Note that only the following map bases are available and attempting to access any others will result in the message "Map base not available - please select another". This simply means that an alternate choice will need to be made for BOUNDS or RESOL.

    POLITICAL BOUNDARIES:
    High resolution - NE quadrant of world
    High resolution - NW quadrant
    High resolution - SE quadrant
    High resolution - SW quadrant
    Medium resolution - western hemisphere
    Medium resolution - entire world
    Low resolution - NW quadrant

    COASTLINE BOUNDARIES:
    Medium resolution - entire world
    Low resolution - entire world

    REGIONAL BOUNDARIES:
    Low resolution - western hemisphere

(2) CDBREAK are the wind magnitude break points for the drag coefficients specified by DRAG. These are used for computations using surface stress, including Ekman transport, Ekman upwelling, wind stress curl, and northward Sverdrup transport. If the null value is kept for CDBREAK, a constant drag coefficient (specified in DRAG(1)) is used. Otherwise, either

one or two values are input for CDBREAK, and two or three values respectively should be entered for DRAG. The values for CDBREAK should be greater than 0 (0 is automatically defined as a break point). The values for DRAG will be applied inclusive of each break point in CDBREAK.

(3) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(4) COLOR is the default graphics plane (for the IIS) or the color index (for the Tektronix) for the drawing of maps, titles, vectors and grids.

(5) COLORS defines the color numbers for each contour which is requested to be drawn. Up to 10 numbers can be entered. For the IIS, this is a graphics plane number and the numbers chosen must be in the range from 1 to 8. For Tektronics/compatibles, this is a color index number, which depends on the current setup of the terminal (this can be changed interactively through Menu key).

(6) CONTOURS are the data values (in physical units) to be contoured. The user may specify up to 10.

(7) DATA_SRC indicates the source of the data to be plotted. If "0" is chosen as the input, the program will gather the data for the specified times and region. If "1" is input, the program will prompt the user for a listing file name. This file can be created from any of the environmental programs which create data of the same type. For instance, one could use a listing created by either GEMPLOT or ENVIMG in either program (exceptions would be fields supported by GEMPLOT but not ENVIMG, e.g. vectors).

(8) DATE is the data range (date and time) to be plotted. The format is:

    YYMMDDHH for CDF data sets.

This is ignored for bathymetry.

(9) DRAG are the drag coefficient values. These are used for computations using surface stress, including Ekman transport, Ekman upwelling, wind stress curl, and northward Sverdrup transport. Each drag coefficient in sequence will be applied to stress computations for wind magnitudes within the corresponding range defined by the entries of CDBREAK. If the null value is kept for CDBREAK, the value of DRAG(1) is used as the constant drag coefficient.

(10) GRDTYP indicates the type of grid to plot ("P" for points, "L" for lines). If points are requested, plus signs will be drawn at each point in the data set. If lines are requested, one will be further prompted for the latitude and longitude intervals (LATINT and LONINT) and label interval (LABFRQ).

(11) INCREM is the time increment which will be used for plotting the data points between the start and end times specified in DATE. The format is:

YYMMDDHH for CDF data sets.

(12) LABFLG is a flag indicating whether or not each contour is to be labelled ("Y"= yes, "N"= no). An entry must be made for each contour (up to 10).

(13) LABFRQ specifies the labelling frequency for the requested grid. The user should enter a "0" for no labels, a "1" for a label every line, a "2" for a label every other line, etc.

(14) LANDMASK indicates whether or not to contour or draw winds over land areas. If "Y" is chosen, contours, streamlines or arrows/barbs will not be plotted over land. If "N" is chosen, the output will be produced even over land if the original dataset has values over land. The determination of land/water is based on data from the NORDA digital bathymetry data base.

(15) LAT defines the latitude limits for the data. Two values must be entered. The first value should be the southernmost limit and the second the northernmost limit. Valid latitude limits for the CDF are dataset-dependent (use CDFLST to list the limits).

(16) LATINT defines the latitude interval in degrees for grid lines that are requested to be drawn.

(17) LENGTH is the length of the arrow with the greatest magnitude (or the value assigned by VALUE) and is expressed relative to the shorter dimension of the output device (i.e. as a fraction between 0. and 1.0). For example, to choose a maximum arrow which is 1/10 the length of the shortest dimension of the current device, set ARROW = 0.1. This means that for the IIS the longest arrow will be 51 pixels long.

(18) LEVEL is the CDF level value of type LEVTYP and must be entered if a LEVTYP other than "NONE" is indicated. The units correspond to the LEVTYP, and will typically be in meters (for depth or height) or millibars (for atmospheric pressure)

(19) LEVTYP is the CDF level type mnemonic and must be specified if applicable. One should enter "NONE" when there is no level information in the CDF (i.e. only data at one level). When multi-level data is present in the dataset, specifying LEVTYP="NONE" will extract only the first level (i.e. whatever level is in the first element of the level array).

(20) LINTYP indicates the line type to be used for other then contours. There are 8 patterns from which to select. A "1" will give a solid line whereas any number in the range 2 to 8 gives various dashed patterns.

(21) LINWID indicates the widths of the line to be drawn for other then contours. An entry of "1" gives a single pixel width line, an entry of "2" gives a line 2 pixels wide, etc.

(22) LINTYPS indicates the type of lines to be used for drawing the contours. There are 8 patterns from which to select for the 10 contours allowable. A "1" will give a solid line whereas any number in the range 2 to 8 gives various dashed patterns.

(23) LINWIDS indicates the widths of the lines to be drawn for the contours. A number must be entered for each contour (maximum of 10). An entry of "1" gives a single pixel width line, an entry of "2" gives a line 2 pixels wide, etc.

(24) LON defines the longitude limits for the data. Two values must be entered. The first value should be the westernmost limit and the second the easternmost limit. Valid longitude limits for the CDF are dataset-dependent (use CDFLST to list the limits).

(25) LONINT defines the longitude interval in degrees for grid lines that are requested to be drawn.

(26) MEANPLT is a flag indicating whether to plot individual times or a mean of all of them. Enter a "0" to draw a separate plot for each time period in the specified range and a "1" to plot only the mean for all the times in the specified range.

(27) METHOD is the drag coefficient computation method. This is used for computations using surface stress, including Ekman transport, Ekman upwelling, wind stress curl, and northward Sverdrup transport. METHOD=1 uses the following formulation taken from Large and Pond (1981),

```
Drag = 1.14 * 10**-3 , | U at 10 m | < 10 m/s
Drag = 10**-3 * (0.49 + 0.065 * | U at 10 m |),
                | U at 10 m | > 10 m/s
```

Method 2 uses linear drag coefficient segments, where the wind magnitude break points are specified in CDBREAK and drag coefficients for ranges between the beaks are specified in DRAG.

(28) PARAM is the mnemonic(s) of the CDF variable to be used in the plotting. To obtain a list of mnemonics of a particular CDF, one should run the program CDFLST. Up to four values for PARAM may be entered. When a raw quantity is desired, specify this in PARAM(1). When a diagnostic quantity is desired, specify the diagnostic mnemonic in PARAM(1), u wind mnemonic in PARAM(2), v wind mnemonic in PARAM(3), and height field mnemonic (if needed for geostrophic computations) in PARAM(4). Possible values of PARAM(1) for diagnostic computations are:

WINDV = total wind vector
WINDGV = geostrophic wind vector
TAUV = surface stress vector, using raw winds
TAUGV = surface stress vector, using geostrophic wind
EKMV = Ekman transport vector, using raw winds
EKMGV = Ekman transport vector, using geostrophic wind
DIV = divergence (1/sec) of raw wind
CURL = vertical component of curl, vorticity (1/sec) of raw wind
DIVG = divergence (1/sec) of geostrophic wind
CURLG = vertical component of curl, vorticity (1/sec) of geos. wind
TAU = total surface stress (N/m**2)

TAUX = E-W surface stress (N/m**2)
TAUY = N-S surface stress (N/m**2)
TAUG = total surface stress (N/m**2) - based on geostrophic winds
TAUGX = E-W surface stress (N/m**2) - based on geostrophic winds
TAUGY = N-S surface stress (N/m**2) - based on geostrophic winds
TAU3 = total surface stress to the 1.5 power (N**1.5/m**3)
TAUG3 = total surface stress ** 1.5 (N**1.5/m**3) - based on geostrophic winds
EKM = total surface Ekman transport (m**2/s)
EKMX = E-W surface Ekman transport (m**2/s)
EKMY = N-S surface Ekman transport (m**2/s)
EKMG = total surface Ekman transport (m**2/s) - based on geostrophic winds
EKMGX = E-W surface Ekman transport (m**2/s) - based on geostrophic. winds
EKMGY = N-S surface Ekman transport (m**2/s) - based on geostrophic winds
EKMD = Ekman depth (m)
UPWEL = Ekman upwelling - based on raw winds (m/s)
UPWELG = Ekman upwelling - based on geostrophic winds (m/s)
WIND = raw wind speed contours (m/s)
WINDG = geostrophic wind speed contours (m/s)
WDDIR = raw wind direction, 0 to 360 degrees
CRLT = curl of total surface stress - based on raw winds (kg/(m**2 * s**2))
CRLTG = curl of total surface stress - based on geostrophic winds (kg/(m**2 * s**2))
NSVT = northward Sverdrup transport - based on raw winds (kg/(m*s))
NSVTG = northward Sverdrup transport - based on geostrophic winds (kg/(m*s))

(29) PROJ specifies the map projection for plotting. The following are acceptable entries:
CED = cylindrical equidistant. Note: This projection must be used when PARM = DIV, DIVG, CURL, CURLG, TAUG, TAUGX, TAUGY, EKMG, EKMGX, EKMGY, UPWEL, UPWELG, WINDG or TAUG3 (i.e. geostrophic computations or computations using curl or divergence).
MCD = modified cylindrical equidistant
MER = mercator
NPS = north polar stereographic
LCC = Lambert conic conformal
UTM = Universal Transverse Mercator

(30) PTITLE is the title for the plot and is placed on the bottom. Up to 80 characters are allowed.

(31) RESOL is the resolution for the map that can be drawn. Allowable inputs are "HI" (high resolution), "ME" (medium resolution) and LO (low resolution). This parameter along with BOUNDS characterizes the map to be drawn. Note that only

certain map bases are available and attempting to access any others will result in the message "Map base not available - please select another". This simply means that an alternate choice for RESOL or BOUNDS will need to be made. See the description under BOUNDS for a list of the available bases.

(32) RE_USE is used to indicate whether or not to keep on using the same scaling definitions for wind arrows if more than one time is requested. If "Y" is chosen, the current definitions for VALUE and LENGTH will be used for all other times in the current sequence. This is ignored if only one plot or the mean of a group of times is being generated.

(33) SONY is a flag indicating whether to mount one or both SONY WORM drives for use in running GEMPLOT. If the default "--" (null) is entered, the program will not use the SONY. If "0" is entered, drive DIATOM::LDB0 will be mounted. If "1" is entered, drive DIATOM::LDB1 will be mounted. If "2" is entered, both drives DIATOM::LDB0 and DIATOM::LDB1 will be mounted. Any SONY drive mounted will be dismounted automatically when the program terminates.

(34) SPACING gives the sampling frequency of the data to be plotted. For example a "1" should be entered to use all the points, a "2" to plot every other point, a "3" to plot every third point, etc. A value needs to be input for the latitude spacing followed by a value for the longitude spacing.

(35) TYPE is the component type for stress-related fields. If a value of "1" is entered, the second and third values for parameter PARAM are assumed to be zonal and meridional components of stress, which are present in the requested CDF. Other quantities such as Ekman upwelling and transport could then be derived directly from the stress components. If a value of "2" is entered, the second and third values for PARAM are assumed to be raw surface wind components. In this case, no cyclonic rotation or decrease in magnitude will be applied to the resultant stress vector. If a value of "3" is entered, the second and third values for PARAM are assumed to be geostrophic wind components. In this case, the resultant stress vector will be rotated cyclonically by 15 degrees and decreased in magnitude by 30% to extrapolate it to a surface value.

(36) VALUE is the arrow value corresponding to LENGTH, in current units. For example, if the maximum wind speed is 9 m/s and LENGTH = 0.1, then one might set VALUE = 10. This would mean that 51 pixels would correspond to a magnitude of 10 m/s on an IIS device.

(37) WDTYPE defines the type of wind marker to use, either barbs (B), arrows (A) or streamlines (S). Wind barbs are standard meteorological markers, where the wind stick points into the wind and the barbs represent magnitude - a long barb representing 10 knots and a short one 5 knots. Wind arrows blow with the wind, with the length of the vector proportional to velocity. Wind streamlines simply follow the flow pattern, indicating direction but not magnitude of the wind. The

spacing of the streamlines has no significance pertaining to the magnitude.

(38) XBOUNDS defines the left and right window limits for the plots, with the left most part of the screen having a value of 0.0 and the right most a value of 1.0. This allows the user to access different parts of the screen for various plots. For example, entering (0.0,0.5) causes the graphics window to cover the left half of the screen. It should be noted that the plots do not use the full graphics window defined by XBOUNDS and YBOUNDS, thus when one wants to overlay a plot on an image, the user must record the actual plot corner coordinates that are output and match the image to this size using the flexibility within the program MAPIMG.

(39) YBOUNDS defines the lower and upper window limits for the plots, with the bottom most part of the screen having a value of 0.0 and the top most a value of 1.0. Entering (0.0,0.5) causes the graphics window to cover the bottom half of the screen, for example.

**TUTOR DRIVEN MODE:**
For the non-IIS output device, the GEMPLOT program is interactively driven through a main menu whose only parameter is called CHOICE. The list of responses that the program accepts for CHOICE are:

1 = Create default title
2 = Specify time/increment, data, grid, projection
3 = EXIT
5 = Create output field (contours or vector arrows)
6 = Create grid
7 = Create gridpoint locations
8 = Clear graphics (TEK,Mac,HP) - for HP a new sheet will be loaded
9 = Change color, line, view region
10 = Create map
11 = Draw graphics (VT240/241)
12 = Save/restore graphics
15 = Display grid values and statistics
16 = Start journaling
17 = Stop journaling

These choices initiate prompts to the user for the necessary parameters contained in PARAMETERS or DYNAMIC PARAMETERS. The actions initiated are similar to the actions initiated with the IIS buttons when the IIS is being used.

**IIS BUTTON DEFINITIONS:**
When the IIS is being used, the button menu is the means to interactively react with GEMPLOT. Each button initiates a certain action requiring further input, so the user will be prompted for more parameters. These parameters are defined in the sections PARAMETERS or DYNAMIC PARAMETERS.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Drop New Scene | Change Refresh Memory | SEAPAK Annotation | Save/ Restore Graphics Plane | Exit |
| 2 | Draw Vector Barb, Arrows, Streamlines | Graphics Planes On/Off/ Erase | Change Line or Color Attributes, View Reg | Draw Map | Change Time Increment, Data,Grid, Projections |
| 1 | | Draw Contours | Display Grid Values and Statistics | Draw Grid or Gridpoint Locations | Write Default Title |

A2: Vector quantities can be plotted with this button.

A3: This button enables the user to put a new image in the IIS refresh memory and display it by calling the program IMAGE. The parameters for that program are defined in its respective section. The image displayed must be a mapped image.

B1: Contours of selected parameters can be drawn using this button.

B2: Selected graphics planes can be toggled on/off or erased by this button. The user is prompted with the parameters PLANES and ONOFF. PLANES is a list of up to 7 graphics planes to be turned on, off or erased. ONOFF specifies the action to be performed for each plane. A "0" turns the plane off (disables it); a "1" turns it on (enables it); a "2" erases the plane (clears it).

B3: This button allows the user to select a different refresh memory on the IIS by calling the program SELECT. A description of its parameters is given in the section which discusses that program.

C1: This button outputs the value of the data selected for each data grid point, along with the minimum, maximum, average and standard deviation of all the data points. One is prompted with the parameter DEST which designates whether the output should go to the terminal (enter a "T"), the printer (enter a "P") or to a disk file (enter an "F").

C2: Some of the graphics characteristics can be changed with this button. The line type (dashed, solid, etc.), width and color can all be changed through the prompted parameters. The graphics window can also be changed to allow for multiple graphics outputs on the screen in different locations (XBOUNDS and YBOUNDS).

C3: This button calls the program ANNOTATE which allows one to enter text on graphics planes or the image itself. See that

-program write-up for a description of the parameters and button menu. When one enters the parameters and types "RUN", the button menu for ANNOTATE is dropped. To return to GEMPLOT and its button menu, depress the EXIT button, F3.

D1: The graphics region can be overlaid with a latitude/longitude grid or with just the grid points. The specific latitude/longitude and spacings are user selected.

D2: A map can be drawn for the region of interest. The type of map is user selectable.

D3: This button calls the program BPSAV which enables the user to save to or restore from a graphics file. See that program write-up for a description of the parameters.

F1: A title may be placed at the bottom of the graphics output using this button.

F2: This button is used to change time ranges, time increment, data type, grid limits, or map projection type.

F3: This button is used to exit the program.

**PROGRAM NAME:** GPKILL
**DATE:** 4/15/91
**MENU:** UTILANL

**DESCRIPTION:** This is a Command Procedure to kill the GPLT subprocess running under TAE (this subprocess is running when the GEMPLOT, ASCENV, TIMENV or ENVIMG program is executed). When a CTRL-C prematurely aborts one of these programs and the GPLT subprocess remains active, this program should be executed. Failure to run GPKILL in this circumstance will result in these programs hanging up in subsequent runs during the current login session. There are no parameters to be entered.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
The IIS is not used in this program.

**PROGRAM NAME:** GRAYBAR
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** The program GRAYBAR will draw a gray bar on the screen using the IIS split screen mode. The gray bar will be displayed over the current image, but will in fact only be written on the IIS memory designated by CHANNEL. It will also draw tick marks set at user-selected intervals with labels in a selected graphics plane. The user may also select the range, width, and position (top, bottom, left, or right) of the gray bar. GRAYBAR uses a split screen, therefore the following error conditions can occur:

1) If split screen is already set up, the program cannot run. Use SELECT to disable the split screen.
2) If the foreground of a channel pair (channels 1 and 8, or 2 and 9, etc. which are on the same physical IIS board) is displayed and the background is selected for the gray bar or vice-versa, the split screen cannot be setup. Please specify a different channel.

**PARAMETERS:**

(1) CHANNEL specifies the channel (IIS memory plane) in which to draw the gray bar. Since a split screen is used, this can be different from the currently displayed image thus allowing one to display a grayscale without overwriting one's image. Note that it cannot be the background (channel pair) of any channel already displayed.

(2) WIDTH tells how wide the gray bar should be in pixels. It can have any value from 10 to 511. The gray bar will always run the full length of the screen if horizontal or the full screen height if vertical. WIDTH is simply saying how wide this "ribbon" will be.

(3) TICK is the parameter which tells how far apart to place the tick marks. It can have any value from 10 to 256, or it can be 0, meaning that no tick marks are to be used. Note that spacing goes by levels of gray and not by pixels, so if the range is smaller, the tick marks will be farther apart, even though TICK remains the same.

(4) RANGE defines the range of gray level values to be displayed in the gray bar. Two values between 0 and 255 inclusive are to be entered. It will always automatically spread the gray bar out over the width of the screen no matter what range is to be displayed.

(5) POSITION specifies the location or position of the gray bar on the display. The acceptable inputs are TOP, BOTTOM, LEFT, or RIGHT. The gray bar is put along one of these four edges.

(6) PLANE specifies in which graphics plane to put the labeling of the tick marks. If zero, it will not label the tick marks.

BPCOLOR can be used to change the colors of the planes if desired.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** GRDMEAN
**DATE:** 4/15/91
**MENU:** GRIDANL

**DESCRIPTION:** This program produces a mean of data in a blotched area over a gridded SEAPAK environmental data image. The image is assumed to have equally spaced latitudes and longitudes. The blotch can be specified in a manner similar to that in HIST, where it can be a full-image blotch, or an inclusive or exclusive blotch. The mean of all valid pixels falling in the limits of the defined blotch area is computed by weighting the mean of pixels in each image line of the blotch by that line's latitude (by multiplying by cos(latitude), and then taking the mean of the weighted means). Pixels are "valid" when they fall within the limits of the blotch and when their geophysical value falls within limits specified by the RANGE parameter. Gray level is converted to geophysical quantities by specification of MODE and FACTOR as in programs like TSERIES. In addition to whole-blotch statistics, line-by-line statistics within the blotch can be chosen. Line-by-line computations, in addition to the computation of mean value, total number of pixels within the blotch and total number of valid pixels within the blotch (which are printed when requested for the entire blotch), also include area per pixel, total area in blotch, total valid area in blotch, zonally integrated mean value, and latitude value.

The program can be run in IIS or non-IIS modes. In IIS mode, a gridded image and associated blotch are assumed to be loaded in the IIS refresh and graphics memories before running the program. An interactive button menu allows the user to change channels, images or blotches, or the various TAE parameter inputs before generating the mean statistics. In non-IIS mode, the program can be run in the foreground or in batch, and both the gridded image and blotch file names on disk must be specified. Wildcard inputs are also supported for specification of the gridded images.

**PARAMETERS:**

(1) GRDIMG is the gridded image filename, used for non-IIS (batch) mode of operation only. A wildcard input is acceptable, as long as the total number of images represented by the wildcard name is no more than 200. For each name, if a device is not specified, "SCRATCH:" will be used; if the directory is not specified, the user's root (main) directory will be used. The extension ".IMG" will be used by default if it is omitted from the file name.

Example: "STATFILE" ==> "SCRATCH:[acctname]STATFILE.IMG"

(2) BLNAME is the blotch filename, used for non-IIS (batch) mode of operation only. The blotch file name is used together with

the blotch graphics plane to define the processing region in the input image files. For IIS mode of processing, the blotched region should be previously defined (either be BLOTCH or by BPSAV) and displayed on the IIS display monitor. For the name, if a device is not specified, "SCRATCH:" will be used; if the directory is not specified, the user's root (main) directory will be used. The extension ".BLO" will be used by default if it is omitted from the file name.

Example: "blotch" ==> "SCRATCH:[acctname]BLOTCH.BLO"

(3) BLOTCH is the blotch option, in the range -7 to 7. This parameter lets you define a region of interest for computing the latitude-weighted mean. You should enter a value of 0 if you select to compute a latitude-weighted mean over the entire image. If you are interested in a region of irregular shape, define the region first via the program BLOTCH or drop the blotch file with the program BPSAV and enter the corresponding blotching graphics plane number for this parameter. A negative blotch plane number (-1 to -7) indicates complimentary blotched region.

(4) MODE is the data interpretation mode. Enter 1 (the default value) if the pixel values of the input image represent data (such as temperature) that are linearly related to gray levels (see help text for FACTOR); enter 2 if they represent pigment concentrations (mg/m**3).

(5) FACTOR is the linear scale factor. This parameter is used only if MODE=1, implying a linear data-to-gray mapping function for the input image; otherwise, it is ignored. If FACTOR is positive, it will represent the factor by which to divide the gray values of INFILS' pixels in order to convert them into actual data values; if zero is entered, the slope and intercept for this mapping function will be obtained from the file header of the input disk image file. To retain the gray values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 100.

(6) RANGE is the valid data range (i.e. the range for identifying valid pixels). The two values entered should conform to the MODE specified. Only pixels falling into the specified data range are counted for the statistics calculation. Land and extremely high/low data pixels can be easily excluded from the statistics calculation by entering proper values for this parameter.

(7) PRINT is the output statistics type. A value of "1" indicates that statistics should be generated only for the blotch region as a whole. These statistics will be generated in this case: mean data value within the blotch, total number of pixels in the blotch and the total number of valid pixels in the blotch. A value of "2" indicates that only line-by-line statistics within the blotch should be generated. In this case, the above list of statistics, plus the following, will be

generated: area per pixel, total area in the blotch, total valid area in the blotch, and zonally integrated data value. A value of "3" indicates that both whole-blotch and line-by-line statistics (e.g. all statistics described for PRINT="1" or "2") will be generated. The values of MODE, FACTOR, RANGE, BLOTCH, BLNAME and GRDIMG provided by the user will also be shown in the output no matter what the value of PRINT.

(8) DEST are the destinations for the output statistics. Up to 3 values for DEST may be entered, chosen from the following list: "T" for terminal, "F" for file (with the filename specified in parameter FILE), "P" for system printer.

(9) FILE is the fully qualified VMS filename for the output. A value for FILE needs to be entered only if one of the values for DEST is "F".

**DYNAMIC PARAMETERS:**
Parameters (2) through (9) may be entered dynamically when the program is run in the IIS mode (i.e. when no values are entered for GRDIMG and BLNAME and the image and blotch are loaded on the IIS) by pressing buttons on the IIS keypad, as described below.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Drop New Image | Change Refresh Channel | Restore New Blotch From Disk | | Exit |
| 2 | Change Valid Data Range | Change Type Of Scaling | Change Blotch Specification | | |
| 1 | Change ASCII Output Destination | Change ASCII Output Filename | Change Output Print Type | | Compute Mean Weighted By Latitude |

A1: This button is used to change the location for writing the output statistics, using parameter DEST.

A2: This button is used to redefine the valid data range, using parameter RANGE.

A3: A new image can be dropped to the IIS display by pressing this button. The user will be prompted for the filename to drop.

B1: By pressing this button, the user can change the value of FILE for redirecting the statistical output.

B2: This button can be pressed to modify the values of MODE and FACTOR to influence the gray level scaling.

B3: The program SELECT, for choosing a different IIS refresh memory than the one currently selected, can be activated with this button.

C1: The parameter PRINT, for specifying the type of statistics (whole-blotch or line-by-line) to be computed, can be modified with this button.

C2: The parameter BLOTCH, for specifying blotch plane and an inclusive/exclusive blotch, can be modified with this button.

C3: This button can be used to drop a new blotch to the IIS monitor, by running program BPSAV.

F1: This button begins the computation of the weighted mean statistics for the current image and blotch.

F3: This button is used to exit the program.

**PROGRAM NAME:** GRID
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc will generate a geocoordinate grid with annotation over a displayed image. The image must be a valid SEAPAK image. The IIS Model 75 image display must first be allocated (proc ALLOC). There are no button functions associated with this proc.

**PARAMETERS:**

MAIN MENU PARAMETERS

(1) GRID determines if a grid is to be overlaid on the current image. A "YES" indicates that a grid is desired. A "YES" value for LATS or LONS is not required in order to generate a grid.

(2) DFT_GRID determines if default values for the grid are to be used. A "YES" instructs the proc to use default values for all input parameters associated with the grid lines. A prompt for these parameters will not be issued. DFT_GRID is ignored if GRID = "NO".

(3) LONS determines if longitude labels are to be generated. A "YES" indicates that longitude labels are desired. A "YES" value for GRID is not required in order to generate the labels.

(4) LATS determines if latitude labels are to be generated. A "YES" indicates that latitude labels are desired. A "YES" value for GRID is not required in order to generate the labels.

(5) DFT_LABL determines if default values for the labels are to be used. A "YES" instructs the proc to use default values for all input parameters associated with the grid labels. Prompts for these parameters will not be issued. DFT_LABL is ignored if LATS and LONS are "NO".

DYNAMIC GRID PARAMETERS

(6) LON_RNGE are the longitudinal limits of the grid in degrees. The western limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used. The western limit is used along with the specified spacing (see LON_DELT) and WINDOW to determine which longitudes are displayed. Therefore, if the western limit longitude falls within WINDOW, it will be displayed. However, if the eastern limit longitude falls within WINDOW, it may or may not be displayed depending on the spacing.

(7) LON_DELT are the spacing (in degrees) between longitudes which are to be displayed. Longitudes to be displayed will be the western limit (see LON_RNGE) and all subsequent longitudes which are LON_DELT degrees apart up to the eastern limit. Therefore, the eastern limit longitude will be displayed only

if the longitudinal distance between the limits is a multiple of LON_DELT. Longitudes actually displayed must also be within the area defined by WINDOW. If the null value "--" (default) is entered, a reasonable value will be used based on the longitudinal limits.

(8) LON_INCR is used in the calculating the position of various longitude points along that latitude. LON_INCR (LONgitude_-INCRement) is used to specify the distance in degrees between those longitude points and thus controls how smooth the latitudes appear when drawn. If the null value "--" (default) or a value larger than that specified by LON_DELT is entered, the LON_DELT spacing will be used for LON_INCR. Obviously, if TYPE=2, LON_INCR is not used since only the latitude/longitude intersections are marked.

(9) LAT_RNGE are the latitudinal limits of the grid in degrees. If the null value "--" (default) is entered, the limits specified in the image's header will be used. The southern limit is used along with the specified spacing (see LAT_DELT) and WINDOW to determine which latitudes are displayed. Therefore, if the southern limit latitude falls within WINDOW, it will be displayed. However, if the northern limit latitude falls within WINDOW, it may or may not be displayed depending on the spacing.

(10) LAT_DELT is the spacing (in degrees) between latitudes which are to be displayed. Latitudes to be displayed will be the southern limit (see LON_RNGE) and all subsequent latitudes which are LAT_DELT degrees apart up to the northern limit. Therefore, the northern limit latitude will be displayed only if the latitudinal distance between the limits is a multiple of LAT_DELT. Latitudes actually displayed must also be within the area defined by WINDOW. If the null value "--" (default) is entered, a reasonable value will be used based on the latitudinal limits.

(11) LAT_INCR is used in calculating the position of various latitude points along that longitude. LAT_INCR (LATitude_-INCRement) is used to specify the distance in degrees between those latitude points and thus controls how smooth the longitudes appear when drawn. If the null value "--" (default) or a value larger than that specified by LAT_DELT is entered, the LAT_DELT spacing will be used for LAT_INCR. Obviously, if TYPE=2, LAT_INCR is not used since only the latitude/longitude intersections are marked.

(12) PLANE is the value of the graphics plane to use for the grid and border. If the value is negative, any graphics already on that plane will first be deleted. Plane 1 (positive) is the default value.

(13) TYPE determines the type of line to be drawn. If TYPE=1 (default), the latitudes/longitudes to be displayed will be drawn as lines. If TYPE=2, only the intersections of these latitudes/longitudes will be marked by plus signs ("+").

(14) WINDOW defines a rectangular view area which may be all or part of the entire image display area. Only grid lines

falling within this view area will be displayed. The WINDOW values represent the start pixel, end pixel, start line, and end line numbers of the view area in that order. The maximum display area is 512 pixels wide by 512 lines high and is used by default.

(15) BORDER determines if a line is to be drawn around the view area. If "YES", straight lines will be drawn around the view area defined by the WINDOW grid parameter. "NO" is the default value.

DYNAMIC LABEL PARAMETERS

Longitude Label Parameters:

(16) LON_RNGE are the longitudinal limits (in degrees) of the area eligible for longitude labeling. The western limit must be the first value. If the null value "--" (default) is entered, the limits specified in the image's header will be used. If GRID="YES", the grid's LON_RNGE values will be the default values. LON_RNGE/LON_DELT specify which longitudes are to be labeled whereas LON_LT_R/LON_LT_D specify where along these longitudes the labels are to fall. Geocoordinate points (lat/lon intersections) whose longitudes will be labeled must meet several criteria. First, they must fall within the geographic area specified by LON_RNGE and LON_LT_R. Second, the corresponding image points (pixel/line) must be located within the WINDOW limits. Third, they must fall on longitudes which are zero or more LON_DELT intervals from the western LON_RNGE. Finally, they must fall on latitudes which are zero or more LON_LT_D intervals from the southern LON_LT_R. See these other label parameters for additional information.

(17) LON_DELT is the spacing (in degrees) between longitudes within LON_RNGE which are eligible for longitude labeling. If the null value "--" (default) is entered, a reasonable value will be used based on the longitudinal limits. If GRID="YES", the grid's LON_DELT value will be the default value. See the LON_RNGE label parameter for information on which longitudes are labeled.

(18) LON_LT_R are the latitudinal limits (in degrees) of the area eligible for longitude labeling. If the null value "--" (default) is entered, LAT_RNGE will be used. See the LON_RNGE label parameter for information on which longitudes are labeled.

(19) LON_LT_D is the spacing (in degrees) between latitudes within LON_LT_R at which to label longitudes. If the null value "--" (default) is entered, the spacing will be larger than LON_LT_R; i.e., only one label per longitude will be used along the southern LON_LT_R latitude. See the LON_RNGE label parameter for additional information on which longitudes are labeled.

(20) LON_OFFS are the offsets (in pixels) to apply to longitude labels which would appear at the left, right, top, and bottom edges of the display, respectively. The offsets may be

positive or negative. The left and right offsets are used to obtain a linear equation of the horizontal offset for labels as a function of the pixel (horizontal) location. Likewise, the top and bottom offsets are used to obtain a linear equation of the vertical offset for labels as a function of the line (vertical) location. These offsets may be used to avoid labels overlapping or to place them off the longitudes to which they correspond. If the offsets are all zero (default), the center of each label will be located atop the image point of the geographic location to which it corresponds.

Latitude Label Parameters:

(21) LAT_RNGE are the latitudinal limits (in degrees) of the area eligible for latitude labeling. If the null value "--" (default) is entered, the limits specified in the image's header will be used. If GRID="YES", the grid's LAT_RNGE values will be the default values. LAT_RNGE/LAT_DELT specify which latitudes are to be labeled whereas LAT_LN_R/LAT_LN_D specify where along these latitudes the labels are to fall. Geocoordinate points (lat/lon intersections) whose latitudes will be labeled must meet several criteria. First, they must fall within the geographic area specified by LAT_RNGE and LAT_LN_R. Second, the corresponding image points (pixel/line) must be located within the WINDOW limits. Third, they must fall on latitudes which are zero or more LAT_DELT intervals from the southern LAT_RNGE. Finally, they must fall on longitudes which are zero or more LAT_LN_D intervals from the western LAT_LN_R. See these other label parameters for additional information.

(22) LAT_DELT is the spacing (in degrees) between latitudes within LAT_RNGE which are eligible for latitude labeling. If the null value "--" (default) is entered, a reasonable value will be used based on the latitudinal limits. If GRID="YES", the grid's LAT_DELT value will be the default value. See the LAT_RNGE label parameter for information on which latitudes are labeled.

(23) LAT_LN_R are the longitudinal limits (in degrees) of the area eligible for latitude labeling. The western limit must be the first value. If the null value "--" (default) is entered, LON_RNGE will be used. See the LAT_RNGE label parameter for information on which longitudes are labeled.

(24) LAT_LN_D is the spacing (in degrees) between longitudes within LAT_LN_R at which to label latitudes. If the null value "--" (default) is entered, the spacing will be larger than LAT_LN_R; i.e., only one label per latitude will be used along the western LAT_LN_R longitude. See the LAT_RNGE label parameter for additional information on which longitudes are labeled.

(25) LAT_OFFS are the offsets (in pixels) to apply to latitude labels which would appear at the left, right, top, and bottom edges of the display, respectively. Equivalent to LON_OFFS.

General Label Parameters:

(26) DECIMAL is the number of decimal places to appear in each label. The values of each longitude or latitude will be rounded off to this number of decimal places. If zero (default) is specified, the values will be rounded to the nearest integer and the decimal point will not appear. However, the number of decimal places will be increased if the interval spacing (degrees) is too small to differentiate the label values using the specified DECIMAL or if DECIMAL=0 and the spacing is not a whole number.

(27) PLANE is the value of the graphics plane to use for the labels and border. If the value is negative, any graphics already on that plane will first be deleted. Plane 1 (positive) is the default value. If GRID="YES", the grid's PLANE value will be the default value.

(28) WINDOW defines a rectangular view area which may be all or part of the entire image display area. Only geocoordinate points (latitude/longitude intersections) falling within this view area will be labeled. The WINDOW values represent the start pixel, end pixel, start line, and end line numbers of the view area in that order. The maximum display area is 512 pixels wide by 512 lines high and is used by default. If GRID="YES", the grid's WINDOW values will be the default values.

(29) BORDER determines if a border is to be drawn around the view area. If "YES", straight lines will be drawn around the view area defined by WINDOW label parameter. "NO" is the default value. Note that labels for geocoordinate points located near the edges of WINDOW may overlap the border.

Label Character Parameters:

(30) HEIGHT is the height of the labels' characters in pixels. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of labels and may need to be modified in combination.

(31) ASPECT is the aspect ratio of the labels' characters. Larger values produce tall characters whereas smaller values produce wide characters. Note that characters that are too wide will overlap within a label and will render it illegible. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of labels and may need to be modified in combination.

(32) ROTATION is the rotational angle of labels in degrees clockwise from the horizontal. For ROTATION=0 (default), the labels will be horizontal and right-side up.

(33) ITALIC is the degree of italicization of label characters. The limits are -45 to +45 degrees, where positive values represent a clockwise direction.

(34) H_SPACE is the number of pixels by which to separate characters in labels. HEIGHT, ASPECT, and H_SPACE may all affect the legibility of labels and may need to be modified in combination.

(35) V_SPACE is the number of pixels to leave blank above and below characters within their boxes. The effect of this parameter is only apparent when REV_VID="YES".
(36) REV_VID allows the labels to be displayed in reverse video. If "YES", the labels will appear in "reverse video" in that a box surrounding the characters of each label will be colored in whereas the actual characters will be transparent.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** GRIDPT
**DATE:** 4/15/91
**MENU:** GEOGRAPHIC

**DESCRIPTION:** GRIDPT is used to create an ASCII file of latitude and longitude crossing points. The user specifies the range of latitude and longitude and the increment for each. This ASCII file can then be used in PLOTLOC to overlay small crosses at each point onto any image generated using SEAPAK. This procedure offers an alternative to the line overlay drawn by GRID.

**PARAMETERS:**
(1) OUTFILE is the file name of the ASCII file to be created.
(2) LAT is the range of latitudes to be used.
(3) YINC is the increment in degrees of latitude to be used.
(4) LONG is the range of longitudes to be used.
(5) XINC is the increment in degrees of longitude to be used.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** GRPINTL
**DATE:** 4/15/91
**MENU:** INITIAL

**DESCRIPTION:** The proc GRPINTL initializes the graphics planes to default conditions and allows the user to clear any specified graphics bit plane. The graphics default colors are:

plane 1 --> pink
plane 2 --> red
plane 3 --> green
plane 4 --> yellow
plane 5 --> orange
plane 6 --> cyan
plane 7 --> sand

**PARAMETERS:**
(1) CLRBPL defines the number(s) of the graphics planes to be cleared. This parameter will selectively clear, clear all, or clear no bit planes. If CLRBPL is -1, then all the bit planes will be cleared. The default is CLRBPL=0, which means no planes are cleared, but the colors are reset to the default values. For example:

CLRBPL=(1,5,7) Clears planes 1, 5, and 7
CLRBPL=2 Clears plane 2

**IIS BUTTON DESCRIPTION:**
No buttons are used.

**PROGRAM NAME:** GRPOFF
**DATE:** 4/15/91
**MENU:** GRAPHICS

**DESCRIPTION:** GRPOFF is designed to selectively turn off IIS Model 75 graphics planes. The graphics planes can be turned off one at a time or several at a time. To turn the graphics planes back on, one must either re-intialize the graphics planes with BPINIT (which resets all the graphics planes) or use BPCOLOR (which allows one to selectively turn a plane back on with a specified color).

**PARAMETERS:**
(1) PLANES designates which graphics planes to turn off. Up to 8 values can be entered.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this proc.

**PROGRAM NAME:** HIST
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This procedure will generate frequency and cumulative histogram for the corresponding area of image resident in the display's refresh memory. The inside or outside of a blotch, or the full image, may be specified as the area of interest. The image may be of pigment concentrations or units linearly proportional to the gray scale. Ranges of values in corresponding units may be used to restrict the pixels to consider. The frequency and cumulative histogram may be directed to a graphics plane or to an image channel.

**PARAMETERS:**

(1) MODE is a flag which indicates whether the pixel values of the image represent data (such as temperature or radiance) that are linearly related to gray levels, or pigment concentrations which are non-linear. A "1" should be entered for linear data and a "2" for pigment data.

(2) FACTOR is a linear scale factor used only if MODE=1, i.e. when a linear data-to-gray scale mapping function for the image is used. If non-zero, it will represent the factor by which to divide the gray values of the image pixels in order to convert them into actual data values; if zero, the slope and intercept for this mapping function will be obtained from the header of the disk image file. In order to retain the gray values, enter 1 (the default value).

(3) RANGE: Two values should be entered for this parameter. The values entered define the range of current image pixel values to use for the determination of the histogram. Pixel values less than the smaller RANGE value and those greater than the larger RANGE value will be excluded. Therefore, this range will determine the limits of the X axis of histogram. The values entered should conform to the unit of the image (i.e. pigment concentration or units linearly proportional to gray levels) as specified by MODE and FACT. For example, to exclude only land and cloud pixels, the RANGE values should be 1.0 and 254.0 for gray levels (MODE=1 and FACT=1) or 0.0425 and 39.0 for pigment concentrations (MODE=2).

(4) BPLANE is the number (1 to 7) of the graphics plane containing the blotch area(s) of interest. If the number is positive, only the pixels within the blotch will be considered; if the number is negative, only the pixels outside the blotch will be considered. If 0 is entered, the entire image area (512 x 512) will be used.

(5) GPLANE: Any plane from 1 to 7 may be used except the one on which the blotch (BPLANE) is drawn.

(6) XLABEL is a string up to 35 characters long which will be displayed as the X axis label for the histogram.

(7) TITLE is a string up to 70 characters long which will be displayed as annotation (main title) below the histogram.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Generate blotch | Display or save graphics | Update and process | Automatic process | Exit |
| 2 | Draw freq. histogram in refresh memory | Draw cumul. histogram in refresh memory | Output frequency histogram | Rescale histogram Y axis | On/off cumulative histogram |
| 1 | List channels and images | Display another channel | Save current image | Drop a new image | On/off frequency histogram |

A1: Displays the names of any images currently loaded in the refresh memories and the number of the channel currently displayed.

A2: Prompts for CHANNEL, the refresh memory into which to draw the frequency histogram.

A3: Invokes the proc BLOTCH for defining a blotch. The F3 ("Exit") button on that menu will reset this menu.

B1: Displays a specified channel.
1) NEW_CHAN is the number (1 to 14) of the new channel to display.

B2: Prompts for CHANNEL, the refresh memory into which to draw the cumulative histogram.

B3: Invokes the proc BPSAV for saving graphics into, or displaying graphics from, a disk file.

C1: Saves the currently displayed image to a disk file.
1) SAVENAME is the name of a disk file to create for saving the currently displayed image. The extension ".IMG" will be used by default if it is omitted from the file name.
2) HDR_NAME is the name of a SEAPAK image file from which to copy the header into the image file to create, SAVENAME. If the null value (--) is entered, a zero filled header will be used. The extension ".IMG" will be used by default if it is omitted from the file name.

C2: Outputs the frequency histogram.
1) OUTPUT specifies the destination of the output: 0, to the terminal; 1, to a disk file (see FILNAME); 2, to the printer; 3, to the HP 7550A plotter.

2) FILNAME is the name of a disk file to create for the frequency list output if OUTPUT=1. The extension ".LIS" will be used by default if it is omitted from the file name.

C3: Allows you the user to reset the original input parameters of the proc.

D1: Drops an image into a specified channel.

1) DROPNAME is the name of a disk file containing an image. This image will be dropped into the image display refresh memory specified by CHANNEL. DROPNAME cannot be a full-width image. Such images must be dropped using the proc WINDOW prior to invoking IMGEDIT. The extension ".IMG" will be used by default if it is omitted from the file name.

2) CHANNEL is the number (1 to 14) of the channel in which to drop the file specified in DROPNAME. If CHANNEL is occupied, you will be given the option to overwrite the resident image.

3) OVERWRIT: If prompted, the channel specified to receive the image already contains an image. Do you want to overwrite the image residing in that channel? If "YES", the resident image will be lost; if "NO" this button function will be canceled and you will be returned to the button menu.

D2: Allows the user to rescale the Y axis of the histogram.

1) SCALE are two values specifying the plotting maxima (in percent) of the frequency and the cumulative histograms, respectively. (Enter 0 for free scale.)

2) CLIP: Enter "YES" to clip values greater than SCALE or "NO" to allow all values. Applies to the frequency and the cumulative histograms.

D3: Allows the user to generate histograms by specifying image files and any graphics files containing blotch areas to process.

1) CHANNEL are the numbers (1 to 14) of the channels in which to drop the IMG_FILE images.

2) IMG_FILE are the names of image disk files. The extension ".IMG" will be used by default if it is omitted from any file name. For each IMG_FILE, a histogram output file will be generated for each GRF_FILE specified.

3) GRF_FILE are the names of disk graphics files that contain the blotches on the bit plane BPLANE. The extension ".BLO" will be used by default if it is omitted from any file name. See IMG_FILE.
Notes: 1) If GRF_FILE=--, the histogram will be generated based on the whole image and a blotch is not required. 2) BPLANE is one of the original input parameters and may be changed using button C3. 3) The maximum number of histogram list output files is 9 if the user enters 3 image files and 3 graphic files.

4) DIR is the directory in which to output histogram list and/or graphic files. If DIR=--, the output directory

will be the same as the directory of the first image file IMG_FILE(1). A complete output file's name is generated by the concatenation of DIR and IMG_FILE, GRF_FILE, LISTYPE, and GRFTYPE.

Example: IMG_FILE(1)=D:F1.IMG and
GRF_FILE(1)=OCEAN1$DUB2:[P.QR.S]G2.BLO

| | | | |
|---|---|---|---|
| DIR= | -- | "e:" | "sia5:[x.y]z" |
| LISTYPE= | ".lst" | "a.lis" | ".l" |
| GRFTYPE= | ".bpsav" | "b.gra" | ".b" |

output files' names for
histogram: D:F1_G2.lst, e:F1_G2a.lis, sia5:[x.y]zF1_G2.l
graphics: D:F1_G2.bpsav, e:F1_G2b.gra,
sia5:[x.y]zF1_G2.b

5) LISTYPE is the file type (extension) for the output histogram list files. (-- if no list files.)
6) GRFTYPE is the file type (extension) for the output histogram graphics files. (-- if no graphics files.)
7) HP: -- for no HP output plot; 3 for output to HP 7550A pen plotter.

F1: Toggles the graphics plane of the frequency histogram on and off.
F2: Toggles the graphics plane of the cumulative histogram on and off.
F3: Exits this proc.

**PROGRAM NAME:** IISLST
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** IISLST lists the images placed in the IIS display unit by the user's account. For the IIS display unit currently allocated to the user, SEAPAK creates a table listing for each of the channels (refresh memories) images obtained from disk files or images generated within the refresh memories (by procs such as FEED and STATDIS). IISLST displays on the user's terminal or writes to a specified file (LFILE) the image names in this table. The channel number and the name of the disk file or the method of generation for the corresponding image will be shown. Channels not accessed by you (this account) or not containing images will not be listed.

It is important to note that this list of channels represents all those into which you have loaded or generated an image since the last time you ran INT with the parameter CLRMEM set to "YES" (the default value). Thus, if the proc INT was not run with CLRMEM="YES" during the present session of using the display, the list may not accurately reflect the images residing in the refresh memories.

**PARAMETERS:**

(1) LFILE is the name of the file for the output. One must enter the name of a host disk file to which the list of channels and their contents will be output or leave the default null value "--". If one wants to print the file, one must enter a name and then use the DCL PRINT command. If the default is used, the list will be output to the system's output default (normally, your terminal). For an entered name, if a device or directory are not specified, the currently defined system defaults will be used (normally, the current device and directory). The extension ".LST" will be used by default if it is omitted from the file name. The name must be a valid host file name.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** IMAGE
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** IMAGE loads a disk-resident image into a specified IIS refresh memory(ies). The image to be displayed is 512x512x8 but it may have a various number of header blocks. This number can be specified and thus prevents part of the header from being displayed as part of the image. It is also possible to specify a refresh memory in which to load the image but not to display it on the IIS.

**PARAMETERS:**

(1) FILENAME is the name of the disk file containing the image. This must be a standard 512x512x8 bit image with a known number of header blocks. The extension ".IMG" will be used by default if it is omitted.

(2) CHANNEL is the number(s) of the refresh memory channel(s) to receive the image. This parameter accepts up to 14 values, each of which correspond to the channel desired. The acceptable values are:

```
-1  --  load image into all memories
 1  --  load image into memory 1
 2  --  load image into memory 2
            .
            .
            .
14  --  load image into memory 14
```

EX: CHANNEL = 1 loads an image into memory channel 1.
CHANNEL = (1,2,3) loads an image into memory channels 1,2,3.
CHANNEL = (5,1) loads an image into memory channels 1 and 5.

(3) HDRBLK defines the number of header blocks in the image. This number of records is then skipped when the image data is entered into an IIS memory.

(4) SELECT is the flag which tells the system whether or not to display the image data on the color monitor. The input expected is YES or NO.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** IMAGSAV
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** The proc IMAGSAV saves a 512x512x8 bit image from an IIS channel onto disk. This proc differs from TODISK in that no header is saved with the image. Since no header is saved, many SEAPAK procs will not be able to be used with this image.

**PARAMETERS:**
(1) FILENAME is the name to be assigned to the image disk file. Unless a disk and directory are given, it will be written to the default disk and directory. The file extension ".IMG" will be used by default if it is omitted.
(2) CHANNEL is the number of the IIS refresh memory in which the image to be saved currently resides.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** IMATCH
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** This program will set the gray levels of the output image pixels to a specified value if the gray levels of the corresponding pixels in the input image are within a specified range. The output image will be displayed if requested.

**PARAMETERS:**

(1) IN_NAME is the name of the image disk file whose pixel gray levels will be tested for IN_RANGE values. Pixels that test positive will cause the corresponding OUT_NAME pixels to be set equal to OUT_GRAY. A new version of OUT_NAME will be created and the old version will not be deleted. Note that you can specify the same file for IN_NAME and OUT_NAME in order to reset the values of pixels in that file that fall within IN_RANGE to the OUT_GRAY value. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUT_NAME is the name of the image disk file whose pixels are to be set equal to OUT_GRAY. OUT_NAME pixels corresponding to IN_NAME pixels that test positive for IN_RANGE values will be modified. A new version of OUT_NAME will be created and the old version will not be deleted. Note that you can specify the same file for IN_NAME and OUT_NAME in order to reset the values of pixels in that file that fall within IN_RANGE to the OUT_GRAY value. The extension ".IMG" will be used by default if it is omitted from the file name. The name must be a valid host file name.

(3) IN_RANGE is the gray level range (inclusive) to use for testing IN_NAME pixels. Pixels that test positive will cause the corresponding OUT_NAME pixels to be set equal to OUT_GRAY.

(4) OUT_GRAY is the gray level value at which to set OUT_NAME pixels if the values of corresponding IN_NAME pixels fall within IN_RANGE.

(5) CHANNEL is the channel in which to display the OUT_NAME image after it has been modified. If CHANNEL=0, the image will not be displayed. (Note that the display unit must be allocated to you if CHANNEL>0.)

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** IMGEDIT
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** This proc provides capabilities for cutting and shifting a region of interest (ROI) on a displayed image. These capabilities may be used to generate composite (mosaic) images. The ROI may be specified as being inside or outside the blotch (colored) areas of the current graphics plane. Button functions are provided to define blotch areas and to manipulate the memory channels and graphics planes.

**PARAMETERS:**
(1) PLANE is the number (1-7) of the graphics plane on which to draw a blotch to define the region of interest (ROI). The ROI is used to determine the image area to process (button F1). The graphics plane may be changed using button D3.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define blotch area | Turn graphics plane on/off | Delete current graphics plane | Use next graphics plane | Exit |
| 2 | Display cursor position | | | Save or restore graphics | |
| 1 | List channels and images | Display another channel | Save current image | Drop a new image | Cut/shift image |

A1: Displays the names of any images currently loaded in the refresh memories and the number of the channel currently displayed.
A2: Displays the pixel/line (TV coordinates) of the cursor position.
A3: Invokes the proc BLOTCH and its button menu. Press F3 (EXIT) on that menu to reset the IMGEDIT menu above.
B1: Displays a specified channel.
 1) NEW_CHAN is the number (1 to 14) of the new channel to display.
B3: Turns current graphics planes on if it is off, or off if it is on.

C1: Saves the currently displayed image to a disk file.

1) SAVENAME is the name of a disk file to create for saving the currently displayed image. The extension ".IMG" will be used by default if it is omitted from the file name.

2) HDR_NAME is the name of a SEAPAK image file from which to copy the header into the image file to create, SAVENAME. If the null value (--) is entered, a zero filled header will be used. The extension ".IMG" will be used by default if it is omitted from the file name.

C3: Clears the current graphics plane; any graphics on that plane will be lost.

D1: Drops an image into a specified channel.

1) DROPNAME is the name of a disk file containing an image. This image will be dropped into the image display refresh memory specified by CHANNEL. DROPNAME cannot be a full-width image. Such images must be dropped using the proc WINDOW prior to invoking IMGEDIT. The extension ".IMG" will be used by default if it is omitted from the file name.

2) CHANNEL is the number (1 to 14) of the channel in which to drop the file specified in DROPNAME. If CHANNEL is occupied, you will be given the option to overwrite the resident image.

3) OVERWRIT: If prompted, the channel specified to receive the image already contains an image. Do you want to overwrite the image residing in that channel? If "YES", the resident image will be lost; if "NO" this button function will be canceled and you will be returned to the button menu.

D2: Saves current graphics into a disk file or restores a graphics files onto the display. You will be prompted for OPTION, GRF_FILE, IN_GP, and OUT_GP. These are equivalent to the parameters of the proc BPSAV.

D3: Increments the current graphics plane by one. If that plane is 7, it will be set to 1.

F1: Main processing button.

1) CUT_IMG: If "YES", the areas outside of the region of interest (ROI) will be set to the CUT_VAL gray value in the output channel OUT_CHN. However, if OUT_CHAN is occupied and CUT_IMG="YES", you will be prompted for the option to insert (after any shifting) the ROI into the image residing in OUT_CHAN. You may use this option to compose a mosaic image in OUT_CHAN. When OUT_CHAN is occupied, you will also have the option to cancel the cut/shift function (button F1) or to clear OUT_CHAN before dropping the edited image.

If "NO", the areas outside the ROI will retain the gray values of the corresponding pixels in the input channel. In this case, these areas will appear as in the input channel since they will also not be shifted. (Only the ROI can be shifted.)

The ROI may be defined as being inside or outside the blotch (colored) areas of the current graphics plane (see IN_OUT).

2) CUT_VAL is the gray value (0 to 255) to set the areas outside the region of interest (ROI) if CUT_IMG = "YES".
3) SHIFT: Enter "X/Y" if you will specify the number of pixels to shift the region of interest (ROI) of the input image using DELT_X_Y. Otherwise, if "MANUAL" is specified, you will be able to use the trackball to shift the graphics planes in order to indicate the extent of the shift. If SHIFT="X/Y" and DELT_X_Y=(0,0), no shifting will occur. The ROI may be defined as being inside or outside the blotch (colored) areas of the current graphics plane (see IN_OUT).
4) DELT_X_Y: If SHIFT="X/Y", use DELT_X_Y to specify the number of pixels to shift the region of interest (ROI) of the input image. If SHIFT="X/Y" and DELT_X_Y=(0,0), no shifting will occur.
5) WRAP: Set WRAP(1)="YES" and WRAP(2)="YES" to indicate that wrapping of the region of interest (ROI) is desired for the X (pixel) and Y (line) directions during shifting. Note that when wrapping is not requested, the direction of the shift is important; for example, +256 is not the same as -256.
6) IN_CHAN is the number (1 to 14) of the channel containing the image to be edited.
7) OUT_CHAN is the number (1 to 14) of the channel to receive the edited image. If OUT_CHAN is occupied and cutting is requested (CUT_IMG="YES"), you will be prompted for the option to insert (after any shifting) the region of interest (ROI) into the image residing in OUT_CHAN. You may use this option to compose a mosaic image in OUT_CHAN. When OUT_CHAN is occupied, you will also have the option to cancel the cut/shift function (button F1) or to clear OUT_CHAN before dropping the edited image.
8) DISP_OUT: If "YES", the image generated for OUT_CHAN will be displayed after processing the cut/shift function.
9) IN_OUT: Enter "IN" if the region of interest (ROI) is within the blotch (colored) areas of the current graphics plane; enter "OUT" if it is outside those areas. The ROI is that portion of the IN_CHAN image which will not be cut if CUT_IMG="YES" and will be shifted if a shift has been specified.
10) OVERWRIT: Same as for button D1.
11) ACTION: If prompted, the channel specified to receive the edited image (OUT_CHAN) already contains an image. You may specify one of three options:
    1. "INSERT" will cause the region of interest (ROI) to be inserted (after any shifting) into the image

residing in OUT_CHAN. You may use this option to compose a mosaic image in OUT_CHAN.

2. "CLEAR" will clear OUT_CHAN before dropping the edited image. In this case the image residing in OUT_CHAN image will be lost.
3. "CANCEL" will cancel this button function and you will be returned to the button menu.

F3: Exits this proc.

**PROGRAM NAME:** IMGMULT
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc performs multiplication of up to 5 images which are displayed on the IIS terminal. The multiplication is done via the IIS hardware. The result is automatically scaled to the gray level range 0 - 255. The primary difference between this proc and MULTF is that MULTF converts the image back to real numbers on the host CPU before the multiplication is performed thus retaining a higher precision of accuracy. If this precision or special scaling is not required, IMGMULT can more quickly give the product image. It should also be noted that the image generated under this proc needs to be fed to a specified refresh memory with FEED and then saved to disk with TODISK. Also, since the IIS output function memory (OFM) map may have been changed, the IIS should be initialized with INT after the desired image is saved.

**PARAMETERS:**
(1) CHAN specifies the channel numbers or refresh memories which are to be multiplied. Up to five integers in the range 1 to 14 may be entered.

**IIS BUTTON DEFINITIONS:**
No buttons are required for this proc.

**PROGRAM NAME:** IMGSUM
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc allows the user to perform a weighted summation of two images displayed on the IIS display terminal. The summation is done using the IIS hardware. Automatic scaling to the full image resolution (0-255) is always applied. The primary difference between this proc and ADDF is that ADDF converts the image back to real numbers on the host CPU before the weighted summation is performed thus retaining a higher precision of accuracy. If this precision or special scaling is not required, IMGSUM can more quickly give a summed image. It should also be noted that the image generated under this proc needs to be fed to a specified refresh memory with FEED and then saved to disk with TODISK. Also since the IIS output function memory (OFM) map may have been changed, the IIS should be initialized with INT after the desired image is saved.

**PARAMETERS:**
(1) CHAN specifies the channel numbers of the two input display images. Two integers in the range 1 to 14 should be entered.
(2) WEIGHT represents the corresponding weights or multiplicative factors to be applied to the input images. Negative values are allowed.
(3) SCALE is an output scaling flag. The allowable values and their meaning are:

  1: Output will be automatically scaled, i.e. the maximum values will be set to 255 and the minimum to 0.
  -1: The output represents the weighted sum. (a 1-1 OFM will be loaded.)

**IIS BUTTON DEFINITIONS:**
No IIS buttons are used in this proc.

**PROGRAM NAME:** INT
**DATE:** 4/15/91
**MENU:** INITIAL

**DESCRIPTION:** INT initializes the IIS Model 75 by optionally blanking the image channels, loading linear look-up tables in all the channels, establishing a zoom factor of one, setting the scroll offset to zero, creating a cursor at (255, 255), and initializing graphics to a set of default conditions. After one has allocated an IIS (using ALLOC), one should normally execute this proc so that the IIS is reset to a "standard configuration".

**PARAMETERS:**

(1) CLRMEM is the parameter which determines whether the image memory channels are to be cleared. Note that when the memory channels are cleared, the graphics planes are also cleared since they are physically the last channel in the IIS system.

| | |
|---|---|
| CLRMEM = yes | Clear the memory channels. |
| CLRMEM = no | Don't clear the memory channels. |

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** IXFGGEDR
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This program converts and reformats the disk file of level IIb FGGE drifter data into a master index file and a relative data file for further analysis using RDDRIFTER. Initially, the data is copied from tape to disk using TPTODK. The two files will be named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | drifter data launch summary record (index file) |
| [outfile]2.DAT | - | observed data (relative file) |

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixfggedr ¦run=async¦" to start the asynchronous run or type "tutor ixfggedr ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: this program will only need to be run again if a new version of the FGGE IIb drifter data (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of FGGE level IIb drifter data. This data should have been copied from the original input tape using SEAPAK program TPTODK.

(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | drifter data launch summary record (index file) |
| [outfile]2.DAT | - | observed data (relative file) |

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXFRENSD
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This program converts and reformats disk files of French ASCII cruise station data into two index files for further extracting. The ASCII data was created in a spreadsheet format, and represents a restructuring of the original data stream. The output file can be queried using RDFRENSD or RDFRSDBA. It is suggested that this program be submitted either as an asynchronous or as a batch job. One can type "tutor ixfrensd ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixfrensd ¦runtype= batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**

(1) INFILE is the disk file name of the French ASCII station data in spreadsheet format. There are four unique formats amongst the 12 cruises in the data set:

Format 1 (for cruises 7906 and 8001):
year/month/day/lat/lon/depth/temp/salinity/dissolved oxygen/ saturation oxygen/dissolved phosphorus/nitrate/nitrite/ ammonium/silicate/chla/phaeo/light

Format 2 (for cruises 7996 and 7992):
year/month/day/lat/lon/depth/dissolved phosphorus/nitrate/ nitrite/ammonium/chla/phaeo/pri_po/partial nitrogen/partial phosphorus/light

Format 3 (for cruises 7910 and 7912):
year/month/day/lat/lon/depth/temp/salinity/dissolved oxygen/ saturation oxygen/dissolved phosphorus/nitrate/nitrite/ ammonium/silicate/chla/phaeo

Format 4 (for cruises 8201, 8301, 8303, 8401, 8403, 8601):
year/month/day/lat/lon/depth/temp/salinity/dissolved oxygen/ pH/dissolved phosphorus/nitrate/nitrite/atmospheric CO2/ total CO2/chla/phaeo

(2) OUTFILE is the root name of the files to be generated. Two files will be generated:

outfile1.DAT - station data master record 1
outfile2.DAT - observed depth data

(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILE's or if it is to create new OUTFILE's. Specify a value of "1" to create new files or a value of "0" to append to old files.

(4) CUT_DEP is the maximum depth for the data to be converted. All data between the surface and CUT_DEP will be converted.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXNCCLM
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats a disk file of the NODC ASCII formatted Climatological Atlas of the World Ocean, Monthly Analyses (see NODC Environmental Information Summary No. 84-6) into a relative data file. The data set contains only climatological monthly mean temperatures at $1^{\circ}$ resolution and at 19 standard depths (0, 10, 20, 30, 50, 75, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000m). Initially, the tape data was copied to magnetic disk using TPTODK. The indexed data can then be queried for further analysis using RDNCCLM. It is suggested that this program be submitted either as an asynchronous or as a batch job. One can type "tutor ixncclm ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixncclm ¦runtype=batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**
(1) INFILE is the disk file of data created by TPTODK.
(2) OUTFILE is the output file name and only changes when MONTH is January. The data must be converted in monthly order because each month is converted separately but MONTHs February through December are appended to the existing OUTFILE. Thus, unless the MONTH is January, OUTFILE does not change. When the MONTH is January, a new OUTFILE is created.
(3) MONTH is month (1 - 12) to be converted.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXNODCDR
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats the disk file of NODC's ASCII Lagrangian current (drifter) data (NODC file designator F156) into a master index file and a relative data file for further analysis using RDDRIFTER. Initially, the data is copied from tape to disk using TPTODK. The two files will be named as:

[outfile]1.DAT - drifter data launch summary record (index file)
[outfile]2.DAT - observed surface and air temperature, bottom depth and salinity data (relative file)

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixnodcdr ¦run=async¦" to start the asynchronous run or type "tutor ixnodcdr ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: this program will only need to be run again if a new version of the NODC drifter data (or supplemental data) is received.

**PARAMETERS:**
(1) INFILE is the input disk filename of NODC Lagrangian current (drifter) data. This data should have been copied from the original input tape using SEAPAK program TPTODK.
(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

[outfile]1.DAT - drifter data launch summary record (index file)
[outfile]2.DAT - observed surface and air temperature, bottom depth and salinity data (relative file)

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXNODCMD
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats a disk file of NODC ASCII current meter data (NODC file designator F015) into a master index file and a relative data file. Initially, the data is copied from tape to magnetic disk using TPTODK. The indexed data can then be queried for further analysis using RDNODCMD. It is suggested that this program be submitted either as an asynchronous or as a batch job. One can type "tutor ixnodcmd ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixnodcmd ¦runtype=batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**
(1) INFILE is the disk file of data created by TPTODK.
(2) OUTFILE is the root name of the files to be created. The two files will be named as:
outfile1.DAT - index file
outfile2.DAT - observed current, pressure, temperature and salinity data file
(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILEs or if it is to create new OUTFILEs.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXNODCPG
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats the disk file of NODC's ASCII pressure gauge data (NODC file designator F017) into a master index file and a relative data file for further analysis using RDNODCPG. Initially, the data is copied from tape to disk using TPTODK. The two files will be named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | gauge master record I (index file) |
| [outfile]2.DAT | - | observed pressure and temperature (relative file) |

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixnodcpg ¦run=async¦" to start the asynchronous run or type "tutor ixnodcpg ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: this program will only need to be run again if a new version of the NODC pressure gauge data (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of NODC pressure gauge data. This data should have been copied from the original input tape using a utility such as VAX MTU (CTD option).

(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | gauge master record I (index file) |
| [outfile]2.DAT | - | observed pressure and temperature (relative file) |

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXNODCSD
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats a disk file of NODC ASCII hydrographic cast station data and low resolution CTD/STD data (NODC file designators SD and C022) into three index files. The high resolution CTD/STD data (file designator F022) is not supported by IXNODCSD. Initially, the tape data are copied to magnetic disk using TPTODK. The indexed data can then be queried for further analysis using RDNODCSD. It is suggested that this program be submitted either as an asynchronous or as a batch job. One can type "tutor ixnodcsd |runtype=async|" to start the asynchronous job under TAE or type "tutor ixnodcsd |runtype=batch|" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**
(1) INFILE is the disk file of data created by TPTODK.
(2) OUTFILE is the root name of the files to be created. The three files will be named as:

outfile1.DAT - master record index file
outfile2.DAT - index file of temperature, salinity, depth, sigma-t and nutrients at sample depths.
outfile3.DAT - index file of estimated values of temperature, salinity, depth, sigma-t and nutrients at standard depths. File is created only for hydrocast data.

(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILEs or if it is to create new OUTFILEs.
(4) CUT_DEP determines the maximum depth of observed and standard depths to be converted.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXNODCSD_CD
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program takes NODC ASCII CD-ROM format station data and generates an indexed file and a relative data file. Two input modes are supported, data from a disk file (copied through a network from CD-ROM to the VAX) and data on a magnetic tape. If the data are read directly from tape, use the TAPE, UNLOAD and RECSIZ parameters. If the data is read from disk, use the INFIL and RECSIZ parameters. Data can now be read either from 9-track tapes as well as 8 mm or TK50 cartridge tapes. The input for whichever of the two parameters INFIL and TAPE is not being used should be left as the default (null) value. The advantage to using the TAPE option is that many individual files can be read/indexed in one operation. To index multiple disk files with the same information, a TAE script file would have to be run interactively. The output file can be queried using RDNODCSD_CD. It is suggested that this program be submitted either as an asynchronous or as a batch job (except when a script file is run). One can type "tutor ixnodcsd_cd ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixnodcsd_cd ¦runtype=batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**

(1) INFILE is the file name of the NODC ASCII CD-ROM format station data set copied to a disk file. If the default null value is used, the program assumes that the data will be read/indexed directly from a tape as specified by the TAPE parameter.

(2) TAPE allows for the indexing to be executed as data is being read from the tape. The tape drive number, the start file number and the number of files to read/index are required inputs. If the default null value is used, the program assumes that the INFILE will be the input file. To specify an OCF tape drive, enter the number (0 - 4) corresponding to the drive (0 for MFA0, 1 for MFA1, 2 for MSA0, 3 for MTA0, 4 for MTB0, and 5 for MUA0). Note that options 0-4 refer to 9-track tape drives on the OCEAN1 node, while option 5 refers to either an 8 mm drive (on OCEAN1) or TK50 drives (on URCHIN, DIATOM and OCEAN2).

(2) OUTFILE is the root name of the files to be generated. Two files will be generated:

```
outfile1.DAT - index file
outfile2.DAT - depth, temperature and salinity relative
               data file
```

(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILEs (NEWFILE = "0") or if it is to create new OUTFILEs (NEWFILE = "1").
(4) RECSIZ is the record length of the input disk or tape file. Possible inputs are 128 for disk files copied from CD-ROM, or 8192 for an NODC CD-ROM format tape.
(5) UNLOAD is the tape unload flag. Specify "Y" to unload the input tape at the end of a program run, or specify "N" to leave the input tape loaded at the end of a program run (for successive runs). The default null value can be used when input is from a disk file.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXNODCWT
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats a disk file of the NODC ASCII formatted Worldwide Ocean Water Color/Water Transparency Data (see NODC Environmental Information Bulletin No. 87-1) into an index file. Initially, the tape data are copied to magnetic disk using TPTODK. The indexed data can then be queried for further analysis using RDNODCWT. It is suggested that this program be submitted either as an asynchronous or as a batch job. One can type "tutor ixnodcwt ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixnodcwt ¦runtype=batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**
(1) INFILE is the input file name which was created using TPTODK.
(2) OUTFILE is the root name of the file to be created. The file will be named as:

outfile1.DAT - Data master record 1 and water transparency

(3) NEWFILE determines whether or not the data contained in INFILE is to be append to an existing OUTFILE or if a new OUTFILE is to be created.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXPATDR
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This program converts and reformats a disk file of level IIb FGGE drifter data (Patterson processed data) into a master index file and a relative data file for further analysis using RDDRIFTER. Initially, the data are copied from tape to disk using TPTODK. The two files will be named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | drifter data launch summary record (index file) |
| [outfile]2.DAT | - | observed data (relative file) |

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixpatdr |run=async|" to start the asynchronous run or type "tutor ixpatdr |run=batch|" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: This program will only need to be run again if a new version of the FGGE IIb processed drifter data (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of FGGE level IIb processed drifter data. These data should have been copied from the original input tape using SEAPAK program TPTODK.
(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | drifter data launch summary record (index file) |
| [outfile]2.DAT | - | observed data (relative file) |

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXREVDR
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This program converts and reformats the disk file of Reverdin FOCAL drifter data into a master index file and a relative data file for further analysis using RDDRIFTER. Initially, the data is copied from tape to disk using TPTODK. The two files will be named as:

[outfile]1.DAT - drifter data launch summary record (index file)
[outfile]2.DAT - observed data (relative file)

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixrevdr ¦run=async¦" to start the asynchronous run or type "tutor ixrevdr ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: All TYPE 1 drifter files have been converted so that each of the 10 levels in the drifts is a separate file. This program will only need to be run again if a new version of the Reverdin FOCAL drifter data (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of Reverdin FOCAL drifter data. This data should have been copied from the original input tape using SEAPAK program TPTODK.

(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

[outfile]1.DAT - drifter data launch summary record (index file)
[outfile]2.DAT - observed data (relative file)

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXSFCTD
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats the disk file of ASCII CTD data provided by Dr. Perkins (NOARL) for SEQUAL data into a master index file and a relative data file for further analysis using RDSFCTD. Initially, the data is copied from tape to disk using TPTODK. The two files will be named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | CTD master record I (index file) |
| [outfile]2.DAT | - | CTD pressure, temperature, salinity, oxygen data (relative file) |

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it is suggested that the program be run asynchronously or in a batch mode. One can type "tutor ixsfctd ¦run=async¦" to start the asynchronous run or type "tutor ixsfctd ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: this program will only need to be run again if a new version of the Perkins CTD data (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of Perkins' Sequal CTD data. This data should have been copied from the original input tape using SEAPAK program TPTODK.

(2) OUTFILE is the root of the output filenames to be created. Two files will be generated and named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | CTD master record I (index file) |
| [outfile]2.DAT | - | CTD pressure, temperature, salinity, oxygen data (relative file) |

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXSFNAN
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts and reformats the disk file of SEQUAL/FOCAL Nansen cast station data into a master index file and a relative data file for further analysis using RDNODCSD or RDNCSDBA. Initially, the data is copied from tape to disk using TPTODK. The three files will be named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | station data master record 1 (index file) |
| [outfile]2.DAT | - | observed depth data |
| [outfile]3.DAT | - | standard depth data (dummy file for RDNODCSD/RDNCSDBA only) |

where [outfile] is the output file name to be specified by the user.

To avoid long waits when creating the index files, it issuggested that the program be run asynchronously or in a batch mode. One can type "tutor ixsfnan ¦run=async¦" to start the asynchronous run or type "tutor ixsfnan ¦run=batch¦" to start a batch run after the parameters are filled in. The TAE command "show-async" can be used to check the status of an asynchronous run and "show-batch/all" or "batch-status" can be used to check the status of a batch run.

NOTE: this program will only need to be run again if a new version of the SEQUAL/FOCAL Nansen cast (or supplemental data) is received.

**PARAMETERS:**

(1) INFILE is the input disk filename of SEQUAL/FOCAL Nansen cast data. This data should have been copied from the original input tape using SEAPAK program TPTODK.

(2) OUTFILE is the root of the output filenames to be created. Three files will be generated and named as:

| | | |
|---|---|---|
| [outfile]1.DAT | - | station data master record 1 (index file) |
| [outfile]2.DAT | - | observed depth data |
| [outfile]3.DAT | - | standard depth data (dummy file for RDNODCSD/RDNCSDBA only) |

(3) NEWFILE is a flag for the type of file creation to be done. Specify a value of 1 to create new index and relative files (i.e. for the first run) or a value of 2 to append to existing index and relative files (i.e. for second and later runs).

(4) CUT_DEP is the maximum depth range for data to be converted. Only data at depths less than or equal to CUT_DEP will be included in the ingest.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** IXSKDWAY
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This proc converts and reformats a disk file of Skidaway Institute of Oceanography ASCII hydrographic cast station data into two index files. This data is similar to NODC station data (NODC designation SD). Initially, the tape data are copied to magnetic disk using TPTODK. The indexed data can then be queried for further analysis using RDSKDWAY. It is suggested that this proc be submitted either as an asynchronous or as a batch job. One can type "tutor ixskdway |runtype=async|" to start the asynchronous job under TAE or type "tutor ixskdway |runtype=batch|" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**
(1) INFILE is the disk file of data created by TPTODK.
(2) OUTFILE is the root name of the files to be created. The two files will be named as:

outfile1.DAT - index file
outfile2.DAT - data file of observed temperature, salinity, depth, sigma-t and nutrients at sample depths.

(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILEs or if it is to create new OUTFILEs.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** IXSOADS
**DATE:** 4/15/91
**MENU:** NODCIDX

**DESCRIPTION:** This program converts a disk file containing NODC's Southern Ocean Atlas Data Set (SOADS) into two index files for subsequent reading by the program RDSOADS.

**PARAMETERS:**
(1) INFILE is the name of the host file containing the SOADS in the format of NODC's tape used to distribute it. The disk file must be as that read from the NODC tape of the data set: 6,313 records and 1688 bytes/record. The extension ".DAT" will be used by default if it is omitted from the file name.
(2) OUTFILE is the root name for the index files to contain the SOADS. Two index files will be created. The first will have a "1" inserted prior to any filename extension and will contain the header data from each station. The second, with a "2" inserted into the name, will contain the observed data for each of up to 58 depths at each station. The header data file will be keyed by date, latitude, longitude, and country/ship code. The depths data file will be keyed by depth.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** IXXBT
**DATE:** 4/15/91
**MENU:** INDEXIN

**DESCRIPTION:** This program takes an XBT data set and generates an indexed file and a relative data file. Two input modes are supported, data in a disk file (in NODC CD-ROM or non-CD-ROM format or special Reverdin FOCAL drifter-as-XBT format) and data on a magnetic tape (both CD-ROM and non-CD-ROM formats are supported from tape). To use the disk file mode for NODC non-CD-ROM format data, the data should be copied from tape to magnetic disk using the VAX tape utility MTU's CTD function with a file name of INFILE and a RECSIZ of 2540. NODC CD-ROM format data can be copied to the VAX through a network and will have RECSIZ=128. If the data are read directly from tape, use the TAPE, UNLOAD and RECSIZ parameters. If the data are read from disk, use the INFIL and RECSIZ parameters. Data can now be read either from 9-track tapes as well as 8mm or TK50 cartridge tapes. The input for whichever of the two parameters INFIL and TAPE is not being used should be left as the default (null) value. The advantage to using the TAPE option is that many individual files can be read/indexed in one operation. To index multiple disk files with the same information, a TAE script file would have to be run interactively. The output file can be queried using RDXBT. It is suggested that this program be submitted either as an asynchronous or as a batch job (except when a script file is run). One can type "tutor ixxbt ¦runtype=async¦" to start the asynchronous job under TAE or type "tutor ixxbt ¦runtype=batch¦" to start a batch job after the tutor menu parameters have been supplied. TAE command "show-async" or "show batch all" can be used to check the status of the job.

**PARAMETERS:**

(1) INFILE is the file name of the NODC or FOCAL multi-level XBT data set copied to a disk file. If the default null value is used, the program assumes that the data will be read/indexed directly from a tape as specified by the TAPE parameter.

(2) TAPE allows for the indexing to be executed as data are being read from the tape. The tape drive number, the start file number and the number of files to read/index are required inputs. If the default null value is used, the program assumes that the INFILE will be the input file. To specify an OCF tape drive, enter the number (0 - 4) corresponding to the drive (0 for MFA0, 1 for MFA1, 2 for MSA0, 3 for MTA0, 4 for MTB0, and 5 for MUA0). Note that options 0-4 refer to 9-track tape drives on the OCEAN1 node, while option 5 refers to either an 8 mm drive (on OCEAN1) or TK50 drives (on URCHIN, DIATOM and OCEAN2).

(2) OUTFILE is the root name of the files to be generated. Two files will be generated:

outfile1.DAT - index file
outfile2.DAT - depth and temperature relative data file

(3) NEWFILE determines whether or not the data contained in INFILE is to be appended onto existing OUTFILEs (NEWFILE = "0") or if it is to create new OUTFILEs (NEWFILE = "1").

(4) RECSIZ is the record length of the input disk or tape file. Possible inputs are 80 for a FOCAL multi-level drifter disk file, 128 for disk files copied from CD-ROM, 2540 for an NODC non-CD-ROM format tape or disk file, or 8192 for an NODC CD-ROM format tape.

(5) UNLOAD is the tape unload flag. Specify "Y" to unload the input tape at the end of a program run, or specify "N" to leave the input tape loaded at the end of a program run (for successive runs). The default null value can be used when input is from a disk file.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** L2BOX
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This program is designed to allow the user to roam a scene (displaying any band) and extract level-2 information within a 3x3 box. Bands 1 to 4 must be in the same directory with the same name convention because the program must collect information from these files in order to make the computations. The user can modify any of the level-2 input parameters and recalculate and save the results by using the options provided on the button menu. This is particularly useful in fine-tuning images to match validation data without generating final level-2 images.

**PARAMETERS:**

(1) PLANE is the graphics plane (1-7) that will be used to mark the box using the button pad.

(2) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(3) CORR is the index of the correction method to use for calculating total radiances:
    1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
    2: Use correction factors specified by FACTOR.

(4) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(5) ITERATE determines which atmospheric correction algorithm is to be used. If 0, the standard Gordon et al. (1988) algorithm is applied. If 1, the iteration algorithm of Smith and Wilson (1981) is used. If 2, the iteration algorithm of Mueller (1984) is used. If the iteration algorithm is used, the user should try using Angstrom exponents equal to zero. The program assigns zero values to pixels which do not converge after 10 iterations.

(6) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface

reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

(7) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(8) ANGEXP are the Angstrom exponents for bands 1 to 4, respectively. For the Gordon algorithm, the fourth value is not used.

(9) PIGMENT allows the user to specify one of two pigment algorithms. The first is the "branching" algorithm of Gordon et al. (1983):

```
1. if Lw(550)=<0, then P=40.84719 (saturated); else,
2. if Lw(443)>0.15,
      then  P = A2 * (Lw(443)/Lw(550))**B2,          (A)
      where log10(A2)=0.053 and B2=-1.71;
      if P>=1.5 and Lw(520)>0
         then  P = A4 * (Lw(520)/Lw(550))**B4,       (B)
         where log10(A4)=0.522 and B4=-2.44;
         if P<1.5, then use (A) above;
3. if Lw(443)=<0.15 and Lw(520)>0, then use (B) above;
4. if Lw(443)=<0.15 and Lw(520)=<0,
      then P=40.84719 (saturated);
```

where Lw represents the water-leaving radiance for the band of the specified wavelength (nm) and P is the pigment concentration in $mg/m^3$. The second choice is a three-channel algorithm provided by Dennis Clark (see Muller-Karger et al., 1990) which has the form,

```
P = 5.56 * [((Lw(443) + Lw(520))/Lw(550)]**(-2.252)
```

(10) NORMWAT may be any of the following options:

0: subsurface water radiance, Lw_ss
1: normalized surface leaving radiance, [Lw] (Gordon and Clark, 1981).
2: non-normalized surface leaving radiance, Lw
3: transmitted water leaving radiance t_Lw

The calculations are as follows:

```
(1) Obtain the Lw surface water radiance first:
    Lt = Lr + La + t_up * Lw
    t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
    where Lt: total radiance
          Lr: Rayleigh radiance
          La: aerosol radiance
          TauR : Rayleigh optical thickness
          TauOz: ozone optical thickness
          theta: satellite zenith angle
```

```
              t_up : diffuse transmission factor (upward)
              ta   : aerosol transmittance (1.0)
         Note that t_Lw = t_up * Lw
     (2) Calculate the subsurface water radiance Lw_ss:
         Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
         where Wref : refractive index of water (1.34)
               Rho  : Fresnel reflectance
     (3) Calculate the normalized water radiance [Lw]:
         [Lw] = Lw/cos(theta0)/t_down
         t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
         where theta0 : solar zenith angle
               t_down : diffuse transmission factor (sun)
```

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Show Total Radiances | Show Rayleigh Radiances | Show Aerosol Radiances | Show Water Radiances | Exit |
| 2 | | Update Level 2 Parameters | Display Cursor at LAT/LONG | Show Pigment | Process Box |
| 1 | Automatic Process | Type Output File | Output to File | Output to Printer | Mark Box |

A3: Retrieves the 3x3 array and computes the mean of the total radiances for bands 1 to 4.

A1: Will prompt for LLP, an array of latitude/longitude coordinates on the image. At each of these points, a 3x3 square will be drawn in the GPLANE graphics plane and each corresponding 3x3 pixel area will be processed as for button F2. You will then be prompted for FOUT, the name of a file to create for the output of "Show" operations. The extension ".LIS" will be used by default if it is omitted from FOUT.

B3: Outputs the 3x3 array and computes the mean of the Rayleigh radiances for bands 1 to 4.

B2: Prompts the user for revised values of any of the input parameters.

B1: Allows the user to list (type) a file previously saved using C1.

C3: Outputs the 3x3 array and computes the mean of the aerosol radiances for bands 1 to 4.
C2: Prompts the user for the latitude and longitude coordinates to which the cursor will move.
C1: Generates a text file of the arrays and mean values of all quantities and of all input parameters.
D3: Outputs the mean water radiances for bands 1 to 4.
D2: Outputs the mean pigment concentrations for bands 1 to 4.
D1: Prints the results of a "Show" operation.
F3: Exits L2BOX.
F2: In order to use the "Show" buttons after changing the input parameters (B2), press this button first so that the program recomputes the necessary quantities. The latitude and longitude of the cursor will be output to the terminal.
F1: Used to mark the current cursor location in the graphics plane.

**PROGRAM NAME:** L2BOXD
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This program is a derivative of L2BOX and L2DUAL. It is designed to make computations assuming the atmosphere contains two aerosol types, marine haze and dust. The algorithm for estimating the aerosol radiances for each component was developed by Ken Carder at University of South Florida. As in L2DUAL, the computations assume "clear-water" radiances. Like L2BOX, it is designed to allow the user to roam a scene (displaying any band) and extract level-2 information within a 3x3 box. Bands 1 to 4 must be in the same directory with the same name convention because the program must collect information from these files in order to make the computations. The user can modify any of the level-2 input parameters and recalculate and save the results by using the options provided on the button menu. This is particularly useful in fine-tuning images to match validation data without generating final level-2 images.

**PARAMETERS:**

(1) PLANE is the graphics plane (1-7) that will be used to mark the box using the button pad.

(2) CORR is the index of the correction method to use for calculating total radiances:
- 1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
- 2: Use correction factors specified by FACTOR.

(3) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(4) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

(5) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed

on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(6) ANGMARIN is an array of four Angstrom exponents corresponding to bands 1 to 4, respectively. In the Gordon algorithm, the fourth value is never used. These represent the marine haze component.

(7) ANGDUST are similar to ANGMARIN but represent the dust component.

(8) NORMWAT determines if the water radiance values are to be normalized (Gordon and Clark, 1981) in which case specify "YES". Enter "NO" to specify output of subsurface water radiance images. The calculation of the two radiance values are as follows:

```
     (1) Obtain the Lw surface water radiance first:
           Lt = Lr + La + t_up * Lw
           t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
           where Lt: total radiance
                 Lr: Rayleigh radiance
                 La: aerosol radiance
                 TauR : Rayleigh optical thickness
                 TauOz: ozone optical thickness
                 theta: satellite zenith angle
                 t_up : diffuse transmission factor (sensor)
                 ta   : aerosol transmittance (1.0)
     (2) Calculate the subsurface water radiance Lw_ss:
           Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
           where Wref : refractive index of water (1.34)
                 Rho  : Fresnel reflectance
     (3) Calculate the normalized water radiance [Lw]:
           [Lw] = Lw/cos(theta0)/t_down
           t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
           where theta0 : solar zenith angle
                 t_down : diffuse transmission factor (sun)
```

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Show Total Radiances | Show Rayleigh Radiances | Show Aerosol Radiances | Show Water Radiances | Exit |
| 2 | | Update Level 2 Parameters | Display Cursor at LAT/LONG | Show Pigment | Process Box |
| 1 | | Type Output File | Output to File | Output to Printer | Mark Box |

A3: Retrieves the 3x3 array and computes the mean of the total radiances for bands 1 to 4.

B3: Outputs the 3x3 array and computes the mean of the Rayleigh radiances for bands 1 to 4.

B2: Prompts the user for revised values of any of the input parameters.

B1: Allows the user to list (type) a file previously saved using C1.

C3: Outputs the 3x3 array and computes the means of both aerosol radiance components for bands 1 to 4.

C2: Prompts the user for the latitude and longitude coordinates to which the cursor will move.

C1: Generates a text file of the arrays and mean values of all quantities and of all input parameters.

D3: Outputs the mean water radiances for bands 1 to 4.

D2: Outputs the mean pigment concentrations for bands 1 to 4.

D1: Prints the results of a "Show" operation.

F3: Exits L2BOX.

F2: In order to use the "Show" buttons after changing the input parameters (B2), press this button first so that the program recomputes the necessary quantities. The latitude and longitude of the cursor will be output to the terminal.

F1: Used to mark the current cursor location in the graphics plane.

**PROGRAM NAME:** L2CON
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** This proc converts an image from one pigment scaling to another. The INFILE input image will first be converted to data (pigment) values according to INTYPE. These data will then be used to generate the OUTFILE output image according to OUTTYPE.

**PARAMETERS:**

(1) INFILE is the name of the disk file containing the input image you wish to convert. The extension ".IMG" will be used by default if it is omitted from a file name.

(2) OUTFILE is the name of the disk file to create for the converted output image. The extension ".IMG" will be used by default if it is omitted from a file name.

(3) INTYPE may be set to 1, 2, or 3 to specify the pigment scaling function used to produce the INFILE image:

    1: SEAPAK pigment scaling function;
    2: Univ. of Miami's DSP scaling function;
    3: linear data-to-gray scaling function (see help text for parameter INFACTOR).

INFILE will first be converted to data (pigment) values according to INTYPE and these data will be used to generate OUTFILE according to OUTTYPE.

(4) OUTTYPE may be set to 1, 2, or 3 to specify the pigment scaling function to use to produce the OUTFILE image:

    1: SEAPAK pigment scaling function;
    2: Univ. of Miami's DSP scaling function;
    3: general power scaling function (see help text for parameter OUTCOEFS).

INFILE will first be converted to data (pigment) values according to INTYPE and these data will be used to generate OUTFILE according to OUTTYPE.

(5) INFACTOR is used only if INTYPE=3, implying a linear data-to-gray mapping function for the INFILE image; otherwise, it is ignored. If INFACTOR is positive, it will represent the factor by which to divide the gray values of INFILE pixels in order to convert them into actual data values. If zero or less is entered, the slope and intercept for this mapping function will be obtained from the file header of the INFILE image file.

(6) OUTCOEFS is used only if OUTTYPE=3. The input gray values will be converted to data (pigment) values according to INTYPE and these values will in turn be converted to new values using the equation:

NEW = A + B*OLD**C

where A, B, and C are the three values of OUTCOEFS, respectively. The new data values will be linearly scaled to gray levels for the OUTFILE image using the minimum and maximum of the new values. The slope and intercept of the linear scaling will be stored in OUTFILE's header.

(7) RANGE specifies the gray-level range of the INFILE input image pixels to convert. INFILE pixels with gray levels below this range will be set to zero (black) for the OUTFILE output image; those with gray levels above this range will be set to 255 (white).

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** L2DUAL
**DATE:** 4/15/91
**MENU:** L2PROD

**DESCRIPTION:** This program is a derivative of L2MULT. It is designed to make computations assuming the atmosphere contains two aerosol types, marine haze and dust. The algorithm for estimating the aerosol radiances for each component was developed by Ken Carder at University of South Florida. The computations assume "clear-water" radiances for all pixels which pass the land/cloud flag (LANCLD). L2DUAL generates seven level-2 image files from the level-1 data. The level-2 products (# = 1 to 7, respectively) are subsurface upwelling water radiances at 440, 520 and 550 nm, aerosol radiance at 670 nm, pigment concentration, Rayleigh radiance at 440 nm, and the dust aerosol radiance (see the parameter ANGDUST). These files are labeled OUTFILEL2#.IMG where OUTFILE is the root name entered by the user and # is defined above.

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root name of the level 2 files. The characters "L2x", where x is as defined in the main help text above, will be inserted prior to the period of the extension. The extension ".IMG" will be used by default if it is omitted from the name. In addition, a text file with an OUTFILE root name and a "L2P" extension is created which contains all the important constants and parameters used in processing the data.

(3) CORR is the index of the correction method to use for calculating total radiances:
 1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
 2: Use correction factors specified by FACTOR.

(4) ANGMARIN is an array of four Angstrom exponents corresponding to bands 1 to 4, respectively. In the Gordon algorithm, the fourth value is never used. These represent the marine haze component.

(5) ANGDUST are similar to ANGMARIN but represent the dust component.

(6) WATER determines the range of valid water radiances required for the purposes of scaling. Values above and below this range are set to 255 and 0 gray levels, respectively.

(7) NORMWAT determines if the water radiance values are to be normalized (Gordon and Clark, 1981) in which case specify "YES". Enter "NO" to specify output of subsurface water

radiance images. The calculation of the two radiance values are as follows:

```
     (1) Obtain the Lw surface water radiance first:
          Lt = Lr + La + t_up * Lw
          t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
          where Lt: total radiance
                Lr: Rayleigh radiance
                La: aerosol radiance
                TauR : Rayleigh optical thickness
                TauOz: ozone optical thickness
                theta: satellite zenith angle
                t_up : diffuse transmission factor (sensor)
                ta   : aerosol transmittance (1.0)
     (2) Calculate the subsurface water radiance Lw_ss:
          Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
          where Wref : refractive index of water (1.34)
                Rho  : Fresnel reflectance
     (3) Calculate the normalized water radiance [Lw]:
          [Lw] = Lw/cos(theta0)/t_down
          t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
          where theta0 : solar zenith angle
                t_down : diffuse transmission factor (sun)
```

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

(8) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(9) LANCLD is the channel 5 threshold in gray-level value used to identify land and clouds. All pixels with values exceeding this value are flagged and assigned a value of 0 (black).

(10) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(11) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The

multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** L2GAC
**DATE:** 4/15/91
**MENU:** L2PROD

**DESCRIPTION:** L2GAC generates six level-2 image files from the level-1 data, providing various options (see the parameter CHOICE) to produce reduced resolution global area coverage (GAC) from full resolution CZCS level-1 image data. (The program is otherwise identical to L2MULT.) The level-2 products (# = 1 to 6, respectively) are subsurface upwelling water radiances at 440, 520 and 550 nm, aerosol radiance at 670 nm, pigment concentration, and Rayleigh radiance at 440 nm. These files are labeled OUTFILEL2#.-IMG where OUTFILE is the root name entered by the user and # is defined above. The program allows for options regarding the atmospheric correction algorithm, land, cloud and aerosol thresholds and water radiance scaling. The atmospheric correction algorithm is discussed in Gordon et al. (1988).

The following table indicates the treatment of individual pixels for given values of the parameters BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC, and the location of a pixel relative to any blotch being used. A dash indicates that the value does not matter; ">" and "=<" indicate that the input pixel value of the appropriate CZCS channel is "greater than" or "less than or equal to" the corresponding flag value.

| BLOTCH | In/Out of Blotch | LANCLD | CLOUD | HAZE | MASKLC | Output Pixel Value |
|---|---|---|---|---|---|---|
| 0 | -- | -- | -- | -- | -- | ALL pixels as water |
| -1 | -- | > | > | -- | YES | 255 (cloud pixel) |
| -1 | -- | > | =< | > | YES | 0 (land/aerosol pixel) |
| -1 | -- | > | =< | =< | YES | 0 (land pixel) |
| -1 | -- | =< | -- | > | YES | 0 (aerosol pixel) |
| -1 | -- | =< | -- | =< | -- | water |
| -1 | -- | > | -- | -- | NO | original value |
| -1 | -- | -- | -- | > | NO | original value |
| >0 | in | > | > | -- | YES | 255 (cloud pixel) |
| >0 | in | > | =< | > | YES | 0 (land/aerosol pixel) |
| >0 | in | > | =< | =< | YES | 0 (land pixel) |
| >0 | in | =< | -- | > | YES | 0 (aerosol pixel) |
| >0 | in | =< | -- | =< | -- | water |
| >0 | in | > | -- | -- | NO | original value |
| >0 | in | -- | -- | > | NO | original value |
| >0 | out | -- | -- | -- | -- | 128 |

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root name of the level 2 files. The characters "L2x", where x is as defined in the main help text above, will be inserted prior to the period of the extension. The extension ".IMG" will be used by default if it is omitted from the name. In addition, a text file with an OUTFILE root name and a "L2P" extension is created which contains all the important constants and parameters used in processing the data.

(3) ANGEXP are the Angstrom exponents for bands 1 to 4, respectively. For the Gordon algorithm, the fourth value is not used.

(4) ITERATE determines which atmospheric correction algorithm is to be used. If 0, the standard Gordon et al. (1988) algorithm is applied. If 1, the iteration algorithm of Smith and Wilson (1981) is used. If the iteration algorithm is used, the user should try using Angstrom exponents equal to zero. The program assigns zero values to pixels which do not converge after 10 iterations.

(5) CORR is the index of the correction method to use for calculating total radiances:
   1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
   2: Use correction factors specified by FACTOR.

(6) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(7) WATER determines the range of valid water radiances required for the purposes of scaling. Values above and below this range are set to 255 and 0 gray levels, respectively.

(8) NORMWAT determines if the water radiance values are to be normalized (Gordon and Clark, 1981) in which case specify "YES". Enter "NO" to specify output of subsurface water radiance images. The calculation of the two radiance values are as follows:

```
     (1) Obtain the Lw surface water radiance first:
          Lt = Lr + La + t_up * Lw
          t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
          where Lt: total radiance
                Lr: Rayleigh radiance
                La: aerosol radiance
                TauR : Rayleigh optical thickness
                TauOz: ozone optical thickness
                theta: satellite zenith angle
                t_up : diffuse transmission factor (sensor)
                ta   : aerosol transmittance (1.0)
     (2) Calculate the subsurface water radiance Lw_ss:
          Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
          where Wref : refractive index of water (1.34)
                Rho  : Fresnel reflectance
     (3) Calculate the normalized water radiance [Lw]:
```

```
[Lw] = Lw/cos(theta0)/t_down
t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
where theta0 : solar zenith angle
      t_down : diffuse transmission factor (sun)
```

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

(9) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(10) PIGMENT allows the user to specify one of two pigment algorithms. The first is the "branching" algorithm of Gordon et al. (1983):

```
1. if Lw(550)=<0, then P=40.84719 (saturated); else,
2. if Lw(443)>0.15,
      then  P = A2 * (Lw(443)/Lw(550))**B2,         (A)
      where log10(A2)=0.053 and B2=-1.71;
      if P>=1.5 and Lw(520)>0
         then  P = A4 * (Lw(520)/Lw(550))**B4,      (B)
         where log10(A4)=0.522 and B4=-2.44;
         if P<1.5, then use (A) above;
3. if Lw(443)=<0.15 and Lw(520)>0, then use (B) above;
4. if Lw(443)=<0.15 and Lw(520)=<0,
      then P=40.84719 (saturated);
```

where Lw represents the water-leaving radiance for the band of the specified wavelength (nm) and P is the pigment concentration in mg/m$^3$. The second choice is a three-channel algorithm provided by Dennis Clark (see Muller-Karger et al., 1990) which has the form,

```
   P = 5.56 * [((Lw(443) + Lw(520))/Lw(550)]**(-2.252)
```

(11) BLOTCH may be used to define a subregion of the scene to be processed and not the rest. A -1 uses the land/cloud/aerosol flags to determine which pixels are to be excluded from analysis. A value of 1-7 references a blotch plane which is loaded in the IIS to determine the area to be processed. Note that the blotch option still applies the land/cloud/aerosol flags within the blotch area. A 0 processes the entire scene without applying any flags. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(12) LANCLD is the channel 5 threshold in gray-level value used to identify land and clouds. All pixels with values exceeding this value are flagged and assigned a value of 0 if BLOTCH is

not 0, MASKLC="YES", and the CLOUD threshold is not exceeded (i.e., it's not a cloud pixel). See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(13) CLOUD is the channel 1 threshold used to identify clouds. If a pixel's gray-level value exceeds this value, the pixel was also flagged by LANCLD, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 255. The program THRES may be used to determine the best land and cloud thresholds for a particular scene. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(14) HAZE is the channel 4 threshold used to identify aerosol pixels. If a pixel's gray-level value exceeds this value, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 0. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(15) MASKLC determines whether or not pixels flagged by LANCLD, CLOUD, and HAZE are assigned values of 0 and 255. If 'NO' is selected, the output values for the flagged pixels in the water radiance images will be the Rayleigh corrected values and the pigment image will have the channel 1 Rayleigh corrected values. 'YES' assigns values of 0 and 255. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(16) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(17) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

(18) CHOICE options are:

1 - For each 4x4 pixel square in the full-resolution level-1 data, computes the level-2 data, average the results (excluding land/cloud), then assigns the averages to all valid pixels in the square.

2 - Takes a central pixel (2,2) of each 4x4 square, computes the level-2 data, then assigns those values to all valid pixels in the square.

3 - For each 4x4 pixel square, computes average valid

radiances, then uses these to compute the level-2 data and assign the result to all valid pixels in the square.

4 - Determines the lowest valid value in band 4, uses the radiances of that pixel to compute the level-2 data and assigns the results to all valid pixels.

5 - This option simulates the sampling strategy used to produce AVHRR GAC from LAC data. It takes 5-sample-by-3-scan-line arrays, and uses the average of the valid radiances from the first four pixels of the first line of each array to produce the level-2 data and assign them to all pixels in each array.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** L2MULT
**DATE:** 4/15/91
**MENU:** L2PROD

**DESCRIPTION:** L2MULT generates six level-2 image files from the level-1 data. The level-2 products (# = 1 to 6, respectively) are subsurface upwelling water radiances at 440, 520 and 550 nm, aerosol radiance at 670 nm, pigment concentration, and Rayleigh radiance at 440 nm. These files are labeled OUTFILEL2#.IMG where OUTFILE is the root name entered by the user and # is defined above. The program allows for options regarding the atmospheric correction algorithm, land, cloud and aerosol thresholds and water radiance scaling. The atmospheric correction algorithm is discussed in Gordon et al. (1988).

The following table indicates the treatment of individual pixels for given values of the parameters BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC, and the location of a pixel relative to any blotch being used. A dash indicates that the value does not matter; ">" and "=<" indicate that the input pixel value of the appropriate CZCS channel is "greater than" or "less than or equal to" the corresponding flag value.

| BLOTCH | In/Out of Blotch | LANCLD | CLOUD | HAZE | MASKLC | Output Pixel Value |
|---|---|---|---|---|---|---|
| 0 | -- | -- | -- | -- | -- | ALL pixels as water |
| -1 | -- | > | > | -- | YES | 255 (cloud pixel) |
| -1 | -- | > | =< | > | YES | 0 (land/aerosol pixel) |
| -1 | -- | > | =< | =< | YES | 0 (land pixel) |
| -1 | -- | =< | -- | > | YES | 0 (aerosol pixel) |
| -1 | -- | =< | -- | =< | -- | water |
| -1 | -- | > | -- | -- | NO | original value |
| -1 | -- | -- | -- | > | NO | original value |
| >0 | in | > | > | -- | YES | 255 (cloud pixel) |
| >0 | in | > | =< | > | YES | 0 (land/aerosol pixel) |
| >0 | in | > | =< | =< | YES | 0 (land pixel) |
| >0 | in | =< | -- | > | YES | 0 (aerosol pixel) |
| >0 | in | =< | -- | =< | -- | water |
| >0 | in | > | -- | -- | NO | original value |
| >0 | in | -- | -- | > | NO | original value |
| >0 | out | -- | -- | -- | -- | 128 |

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root name of the level 2 files. The characters "L2x", where x is as defined in the main help text above, will be inserted prior to the period of the extension. The

extension ".IMG" will be used by default if it is omitted from the name. In addition, a text file with an OUTFILE root name and a "L2P" extension is created which contains all the important constants and parameters used in processing the data.

(3) ANGEXP are the Angstrom exponents for bands 1 to 4, respectively. For the Gordon algorithm, the fourth value is not used.

(4) ITERATE determines which atmospheric correction algorithm is to be used. If 0, the standard Gordon et al. (1988) algorithm is applied. If 1, the iteration algorithm of Smith and Wilson (1981) is used. If 2, the iteration algorithm of Mueller (1984) is used. If the iteration algorithm is used, the user should try using Angstrom exponents equal to zero. The program assigns zero values to pixels which do not converge after 10 iterations.

(5) CORR is the index of the correction method to use for calculating total radiances:
   1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
   2: Use correction factors specified by FACTOR.

(6) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(7) WATER determines the range of valid water radiances required for the purposes of scaling. Values above and below this range are set to 255 and 0 gray levels, respectively.

(8) NORMWAT determines if the water radiance values are to be normalized (Gordon and Clark, 1981) in which case specify "YES". Enter "NO" to specify output of subsurface water radiance images. The calculation of the two radiance values are as follows:

```
(1) Obtain the Lw surface water radiance first:
      Lt = Lr + La + t_up * Lw
      t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
      where Lt: total radiance
            Lr: Rayleigh radiance
            La: aerosol radiance
            TauR : Rayleigh optical thickness
            TauOz: ozone optical thickness
            theta: satellite zenith angle
            t_up : diffuse transmission factor (sensor)
            ta   : aerosol transmittance (1.0)
(2) Calculate the subsurface water radiance Lw_ss:
      Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
      where Wref : refractive index of water (1.34)
            Rho  : Fresnel reflectance
(3) Calculate the normalized water radiance [Lw]:
      [Lw] = Lw/cos(theta0)/t_down
      t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
```

where theta0 : solar zenith angle
t_down : diffuse transmission factor (sun)

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

(9) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(10) PIGMENT allows the user to specify one of two pigment algorithms. The first is the "branching" algorithm of Gordon et al. (1983):

```
1. if Lw(550)=<0, then P=40.84719 (saturated); else,
2. if Lw(443)>0.15,
      then  P = A2 * (Lw(443)/Lw(550))**B2,          (A)
      where log10(A2)=0.053 and B2=-1.71;
      if P>=1.5 and Lw(520)>0
         then  P = A4 * (Lw(520)/Lw(550))**B4,       (B)
         where log10(A4)=0.522 and B4=-2.44;
         if P<1.5, then use (A) above;
3. if Lw(443)=<0.15 and Lw(520)>0, then use (B) above;
4. if Lw(443)=<0.15 and Lw(520)=<0,
      then P=40.84719 (saturated);
```

where Lw represents the water-leaving radiance for the band of the specified wavelength (nm) and P is the pigment concentration in mg/m$^3$. The second choice is a three-channel algorithm provided by Dennis Clark (see Muller-Karger et al., 1990) which has the form,

```
P = 5.56 * [((Lw(443) + Lw(520))/Lw(550)]**(-2.252)
```

(11) BLOTCH may be used to define a subregion of the scene to be processed and not the rest. A -1 uses the land/cloud/aerosol flags to determine which pixels are to be excluded from analysis. A value of 1-7 references a blotch plane which is loaded in the IIS to determine the area to be processed. Note that the blotch option still applies the land/cloud/aerosol flags within the blotch area. A 0 processes the entire scene without applying any flags. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(12) LANCLD is the channel 5 threshold in gray-level value used to identify land and clouds. All pixels with values exceeding this value are flagged and assigned a value of 0 if BLOTCH is not 0, MASKLC="YES", and the CLOUD threshold is not exceeded (i.e., it's not a cloud pixel). See the main help text above

for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(13) CLOUD is the channel 1 threshold used to identify clouds. If a pixel's gray-level value exceeds this value, the pixel was also flagged by LANCLD, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 255. The program THRES may be used to determine the best land and cloud thresholds for a particular scene. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(14) HAZE is the channel 4 threshold used to identify aerosol pixels. If a pixel's gray-level value exceeds this value, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 0. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(15) MASKLC determines whether or not pixels flagged by LANCLD, CLOUD, and HAZE are assigned values of 0 and 255. If 'NO' is selected, the output values for the flagged pixels in the water radiance images will be the Rayleigh corrected values and the pigment image will have the channel 1 Rayleigh corrected values. 'YES' assigns values of 0 and 255. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(16) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

(17) MULTIS is an option for selecting one of two multiple scattering Rayleigh correction models. The "scalar" multiple scattering model is an approximation which uses a three dimensional array with axes corresponding to three angles used to compute the Rayleigh radiance. The values in the array are ratios of single to multiple scattering radiance as computed from the scalar version of the Dave Code assuming zero surface albedo. By ignoring minor wavelength dependencies due to ozone, one array for all wavelengths is possible. The multiple scattering algorithm simply interpolates between the values in the table and multiplies it by the single scattering result (excluding the term associated with direct surface reflection in the Gordon et al., 1983, algorithm). The "exact" option is based on Gordon et al. (1988).

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** L2SNGL
**DATE:** 4/15/91
**MENU:** L2PROD

**DESCRIPTION:** L2SNGL generates six level-2 image files from the level-1 data. The level-2 products (# = 1 to 6, respectively) are subsurface upwelling water radiances at 440, 520 and 550 nm, aerosol radiance at 670 nm, pigment concentration, and Rayleigh radiance at 440 nm. These files are labeled OUTFILEL2#.IMG where OUTFILE is the root name entered by the user and # is defined above. The program allows for options regarding the atmospheric correction algorithm, land, cloud and aerosol thresholds and water radiance scaling. The atmospheric correction algorithm is the single scattering algorithm outlined in Gordon et al. (1983).

The following table indicates the treatment of individual pixels for given values of the parameters BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC, and the location of a pixel relative to any blotch being used. A dash indicates that the value does not matter; ">" and "=<" indicate that the input pixel value of the appropriate CZCS channel is "greater than" or "less than or equal to" the corresponding flag value.

| BLOTCH | In/Out of Blotch | LANCLD | CLOUD | HAZE | MASKLC | Output Pixel Value |
|---|---|---|---|---|---|---|
| 0 | -- | -- | -- | -- | -- | ALL pixels as water |
| -1 | -- | > | > | -- | YES | 255 (cloud pixel) |
| -1 | -- | > | =< | > | YES | 0 (land/aerosol pixel) |
| -1 | -- | > | =< | =< | YES | 0 (land pixel) |
| -1 | -- | =< | -- | > | YES | 0 (aerosol pixel) |
| -1 | -- | =< | -- | =< | -- | water |
| -1 | -- | > | -- | -- | NO | original value |
| -1 | -- | -- | -- | > | NO | original value |
| >0 | in | > | > | -- | YES | 255 (cloud pixel) |
| >0 | in | > | =< | > | YES | 0 (land/aerosol pixel) |
| >0 | in | > | =< | =< | YES | 0 (land pixel) |
| >0 | in | =< | -- | > | YES | 0 (aerosol pixel) |
| >0 | in | =< | -- | =< | -- | water |
| >0 | in | > | -- | -- | NO | original value |
| >0 | in | -- | -- | > | NO | original value |
| >0 | out | -- | -- | -- | -- | 128 |

**PARAMETERS:**

(1) INFILE is the name of an unmapped, level 1 CZCS, SEAPAK image (including the band digit). The program will need to access all five band images associated with the specified file. (Any of the five may be specified.) These files should therefore reside in the same directory. The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the root name of the level 2 files. The characters "L2x", where x is as defined in the main help text above, will be inserted prior to the period of the extension. The

extension ".IMG" will be used by default if it is omitted from the name. In addition, a text file with an OUTFILE root name and a "L2P" extension is created which contains all the important constants and parameters used in processing the data.

(3) ANGEXP are the Angstrom exponents for bands 1 to 4, respectively. For the Gordon algorithm, the fourth value is not used.

(4) ITERATE determines which atmospheric correction algorithm is to be used. If 0, the standard Gordon et al. (1988) algorithm is applied. If 1, the iteration algorithm of Smith and Wilson (1981) is used. If 2, the iteration algorithm of Mueller (1984) is used. If the iteration algorithm is used, the user should try using Angstrom exponents equal to zero. The program assigns zero values to pixels which do not converge after 10 iterations.

(5) CORR is the index of the correction method to use for calculating total radiances:
   1: Use factors and method (time and gain dependent) of R. Evans (Univ. of Miami).
   2: Use correction factors specified by FACTOR.

(6) ILTOPT specifies the ILT option: If "YES", ephemeris data from the ILT record of the level-1 scene will be used. If "NO", much of these data will be obtained from the documentation record or calculated by SEAPAK based on the location and time at the start of the scene.

(7) WATER determines the range of valid water radiances required for the purposes of scaling. Values above and below this range are set to 255 and 0 gray levels, respectively.

(8) NORMWAT determines if the water radiance values are to be normalized (Gordon and Clark, 1981) in which case specify "YES". Enter "NO" to specify output of subsurface water radiance images. The calculation of the two radiance values are as follows:

```
(1) Obtain the Lw surface water radiance first:
      Lt = Lr + La + t_up * Lw
      t_up = exp(-(tauR/2 + tauOz)/cos(theta)) * ta
      where Lt: total radiance
            Lr: Rayleigh radiance
            La: aerosol radiance
            TauR : Rayleigh optical thickness
            TauOz: ozone optical thickness
            theta: satellite zenith angle
            t_up : diffuse transmission factor (sensor)
            ta   : aerosol transmittance (1.0)
(2) Calculate the subsurface water radiance Lw_ss:
      Lw_ss = Wref * Wref * Lw / (1.0 - Rho)
      where Wref : refractive index of water (1.34)
            Rho  : Fresnel reflectance
(3) Calculate the normalized water radiance [Lw]:
      [Lw] = Lw/cos(theta0)/t_down
      t_down =  exp(- (TauR/2 + TauOz)/cos(theta0))
```

where theta0 : solar zenith angle
t_down : diffuse transmission factor (sun)

The [Lw] calculated should be nearly independent of the solar zenith angle. For pigment concentrations less than 0.25 mg/m3, the values for 520nm and 550nm should be about 0.30 and 0.50, respectively.

(9) OZONE are the optical thicknesses (in meters) for bands 1 to 4, respectively. If the null value "--" (default) is entered, the values used will be from the TOMS database for the day of the input CZCS scene and for the point nearest to the image center. If the TOMS data point is missing or an error occurs accessing the data, a message to that effect will be displayed on the terminal along with the default values. These default thicknesses are 0.00106, 0.0144, 0.0279, and 0.0125, and are the products of the absorption coefficients (3.4E-6, 46E-6, 89E-6, and 40E-6) used at the Univ. of Miami and an average amount of 313 Dobson units of ozone.

(10) PIGMENT allows the user to specify one of two pigment algorithms. The first is the "branching" algorithm of Gordon et al. (1983):

```
1. if Lw(550)=<0, then P=40.84719 (saturated); else,
2. if Lw(443)>0.15,
      then  P = A2 * (Lw(443)/Lw(550))**B2,        (A)
      where log10(A2)=0.053 and B2=-1.71;
      if P>=1.5 and Lw(520)>0
         then  P = A4 * (Lw(520)/Lw(550))**B4,     (B)
         where log10(A4)=0.522 and B4=-2.44;
         if P<1.5, then use (A) above;
3. if Lw(443)=<0.15 and Lw(520)>0, then use (B) above;
4. if Lw(443)=<0.15 and Lw(520)=<0,
      then P=40.84719 (saturated);
```

where Lw represents the water-leaving radiance for the band of the specified wavelength (nm) and P is the pigment concentration in mg/m$^3$. The second choice is a three-channel algorithm provided by Dennis Clark (see Muller-Karger et al., 1990) which has the form,

```
P = 5.56 * [((Lw(443) + Lw(520))/Lw(550)]**(-2.252)
```

(11) BLOTCH may be used to define a subregion of the scene to be processed and not the rest. A -1 uses the land/cloud/aerosol flags to determine which pixels are to be excluded from analysis. A value of 1-7 references a blotch plane which is loaded in the IIS to determine the area to be processed. Note that the blotch option still applies the land/cloud/aerosol flags within the blotch area. A 0 processes the entire scene without applying any flags. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(12) LANCLD is the channel 5 threshold in gray-level value used to identify land and clouds. All pixels with values exceeding this value are flagged and assigned a value of 0 if BLOTCH is not 0, MASKLC="YES", and the CLOUD threshold is not exceeded (i.e., it's not a cloud pixel). See the main help text above

for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(13) CLOUD is the channel 1 threshold used to identify clouds. If a pixel's gray-level value exceeds this value, the pixel was also flagged by LANCLD, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 255. The program THRES may be used to determine the best land and cloud thresholds for a particular scene. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(14) HAZE is the channel 4 threshold used to identify aerosol pixels. If a pixel's gray-level value exceeds this value, MASKLC="YES", and BLOTCH is not 0, the pixel will be assigned a value of 0. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(15) MASKLC determines whether or not pixels flagged by LANCLD, CLOUD, and HAZE are assigned values of 0 and 255. If 'NO' is selected, the output values for the flagged pixels in the water radiance images will be the Rayleigh corrected values and the pigment image will have the channel 1 Rayleigh corrected values. 'YES' assigns values of 0 and 255. See the main help text above for information on the interrelationship of BLOTCH, LANCLD, CLOUD, HAZE, and MASKLC.

(16) FACTOR are the correction factors to use for calculating total radiances of bands 1 to 4, respectively. These will be used only when CORR=2.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** LANCLD
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This procedure is used to redefine the land/cloud area of an input CZCS image (usually level 2) using a corresponding CZCS level 1 (usually band 5) image as the land/cloud reference image and a second level 1 (usually band 1) image as the cloud reference image. The default land/cloud threshold used in the land/cloud reference image is 21. The default cloud threshold used in the cloud reference image is 190. Any pixel that is identified as a cloud will be assigned a gray level of 255 while the gray level for land can be defined. The cloud threshold will not be applied to a pixel if it was not flagged by the land/cloud threshold.

NOTE:
1. LANCLD needs an allocated IIS terminal.
2. LANCLD generates an output image on the display monitor which can be saved via TODISK while FLAGLC generates an output image on disk.
3. LANCLD will assume that any pixel that has a gray level of 255 is a cloud, which may not be the case for level 2 products.

**PARAMETERS:**

(1) CLOUD is the refresh memory where the level 1 cloud flag image (usually band 1) is loaded.

(2) LANCLD is the refresh memory where the level 1 land/cloud flag image (usually band 5) is loaded.

(3) IMAGE is the refresh memory where the image to be operated on is loaded.

(4) PLANE refers to a graphics plane which is used in the processing and can be any plane which is not currently being used.

(5) SHADE refers to the desired gray level for the land mask.

(6) TRCLOUD is a value in the range of 0 to 255. This value is used in conjunction with the input cloud reference image to identify clouds from land. Any pixel in the cloud reference image file that has a gray value greater than the entered value is flagged as a cloud.

(7) TRLANCLD is a value in the range of 0 to 255. This value is used in conjunction with the input land/cloud reference image file to identify water from land/clouds. Any pixel in the land/cloud reference image file that has a gray value greater than the entered value is flagged as land/clouds.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** LATLON
**DATE:** 4/15/91
**MENU:** GEOGRAPHIC

**DESCRIPTION:** This proc allows the user to locate specific latitude/longitude locations on a SEAPAK image. The program initially uses the image currently displayed. Two operating modes are provided. In the first, the latitude/longitude of the user positioned cursor can be obtained (this is the mode initially entered). In the second, the cursor is automatically moved to a user specified latitude/longitude. This mode can be changed interactively using the IIS button menu. Once the desired latitude/longitude is obtained, the user has the capability to mark that location on a graphics plane or the refresh memory where the image is displayed. Once the points are marked, a line can be drawn connecting them. When the line is drawn, the distance, in both kilometers and statute miles, and the direction between these points is provided. Options are provided to drop new images into refresh memory channels or select a refresh memory channel which contains an image that had been previously dropped. Other nice features include the ability to list the current images in the IIS refresh memories, turn graphics planes on/off and turn the cursor on/off.

**PARAMETERS:**
No parameters are input. The program starts out initially using the currently displayed image, providing the latitude/longitude for the cursor location and employing graphics plane 1. All of these initial assumptions can be changed via the IIS button menu.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Mark Position on Graphics Plane | Mark Position on Refresh Memory | Connect Last Graphics Positions | Define A New Position | Exit |
| 2 | Erase Last Graphics Position | Use Another Graphics Plane | Erase Last Line Segment | Turn Graphic Plane(s) On/Off | |
| 1 | Display Another Channel | Drop A New Image | List Channels And Images | L/L-Cursor Cursor-L/L | Cursor On/Off |

A3: This button enables the user to mark the current cursor location on the selected graphics plane. The position must be "defined" with button D3 before it can be marked.

A2: This button erases the marks in the graphics planes starting with the most recent. When the most recent mark has been erased, the next to the most recent will be erased when the button is depressed again, etc.

A1: When this button is depressed, one is prompted to select a new refresh memory; NEW_CHAN is the parameter.

B3: This button enables the user to mark the present cursor location on the current refresh memory. The position must be "defined" using button D3 before it can be marked.

B2: The graphics plane can be changed using this button. The user is prompted with the parameter PLANE. Any value in the range of 1 to 7 may be input.

B1: This button allows the user to drop a new image. The parameters requested are FILENAME (the name of the file to display) and CHANNEL (the IIS refresh memory into which to load the image).

C3: Depressing this button allows the user to do two things. The first is to draw a vector between two previously marked (and hence "defined") points. The second is to determine the distance between these two points in kilometers and statute miles. The angle from point 1 to point 2 measured from north is also provided.

C2: The most recently drawn vector can be erased using this button. After the most recent vector has been erased, depressing the button again erases the next most recent vector, etc.

C1: This button causes a list of the images in the IIS refresh memories to be displayed on the terminal. A note of warning is in order. These images are those which have been displayed to the IIS since the last time the user initialized the IIS and cleared the memories, i.e. executed INT with CLRMEM="Yes".

D3: A new latitude/longitude can be defined/determined by depressing this button. If the mode is "latitude/longitude to cursor" (see button D1), the user is requested to input a new set of latitude/longitude values. The cursor will then be placed at that latitude/longitude and the pixel/line coordinates for that point will be displayed. If the mode is "cursor to latitude/longitude", the latitude/longitude values associated with the current cursor location are displayed on the user's terminal.

D2: This button allows one to turn "off" any graphics plane which is "on", or "on" any graphics plane which is "off". The user is prompted to select the plane(s) on which to operate with the parameter GPLANES. Values from 1 to 7 are acceptable.

D1: This button allows the user to toggle between the "cursor to latitude/longitude" mode and the "latitude/longitude to cursor" mode.

F3: This button terminates the LATLON proc.

F1: This button enables one to toggle the cursor on and off.

**PROGRAM NAME:** LOADLUT
**DATE:** 4/15/91
**MENU:** LUT

**DESCRIPTION:** Program LOADLUT loads a linear (f(x)=x) or inverted (f(x)=255-x) mapping into a specified look-up table of the IIS. If one needs to change the output range to values other than (0,255), e.g. (0,127), then one must use LUTMOD.

**PARAMETERS:**

(1) LUTTYPE is a flag indicating which type of mapping to load, linear or inverted. There are 2 acceptable values for LUTTYPE:

1 - load linear (black to white) lut (this is the default)
2 - load inverted (white to black) lut

EX: LUTTYPE=1 implies f(x)=x with mapping of 0 to 0, 1 to 1,...,255 to 255
LUTTYPE=2 implies f(x)=255-x with mapping of 0 to 255, 1 to 254,..., and 255 to 0

(2) CHANNEL is the number(s) of the refresh memory(ies) whose LUT's are to be loaded. The acceptable values for this parameter are:

-1 -- load LUT into all memories
0 -- load LUT into no memories
1 -- load LUT into memory 1
2 -- load LUT into memory 2
.
.
.
14 -- load LUT into memory 14

EX: CHANNEL=(1,4) loads lut into channels 1 and 4
CHANNEL=(1,2,3) loads lut into channels 1,2,3
CHANNEL=6 loads lut into channel 6

(3) COLOR specifies which LUT's to load, i.e. the "RED", "GREEN" and/or "BLUE" look-up tables. The acceptable values for COLOR are RED, GREEN or BLUE or the various combinations thereof.

EX: COLOR=(RED,GREEN,BLUE); this is the default and gives one a black and white image if the same image is assigned to each gun or a pseudocolored image if different images have been assigned to different guns.
COLOR=R indicates that only the red lut is loaded.
COLOR=BL indicates that only the blue lut is loaded.

COLOR=(GR,BLUE) loads both the blue and green lut.

Note that right-hand characters of the color names can be truncated.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this program.

**PROGRAM NAME:** LOGF
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc may be used to take the logarithm of an image file, pixel by pixel, according to the following general equation:

$$OUT = C * logB(I) \quad (1)$$

where OUT is the output data file designated by the parameter OUT_FILE, C is a constant corresponding to the parameter CONST, logB is the logarithm to the base BASE, and I is the image data from the file IN_FILE. The region of interest within the image may be limited by specifying a blotch plane (BPLANE and BLO_FILE). One can limit the calculation only to the areas within or outside of this blotch. LOGF converts the integer numbers of IN_FILE to floating point for its arithmetic operations and hence maintains excellent accuracy. Consequently, OUT_FILE is used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. For a given pixel, if any IN_FILE value falls outside the RANGE values, or if an arithmetic error occurs during logarithm calculation, OUT for that pixel will be flagged as "invalid" and subsequently assigned a value that is specified in the proc STATDIS.

**PARAMETERS:**

(1) IN_FILE is the name of the disk resident input image file one wants to process (the I in equation (1) above). The extension ".IMG" will be used by default if it is omitted from the file name. The file must be an image data file such as that produced by the procs TODISK and STATDIS (i.e., it contains 513 blocks, one of which is a header block).

(2) BASE is the logarithmic base to be used in equation (1) for processing each pixel. For a straight logarithm, set C=1 (the default value). BASE can be any number greater than one. Its default value is 10. Arithmetic errors may occur during calculations if inappropriate CONST, BASE, or input values are used. For example, errors will occur if OUT values are too large or too small or if zero or negative input image pixel values are present. Output data values of pixels for which arithmetic errors have occurred will be flagged as "invalid" and may be assigned any desired value when using the proc STATDIS. (See the documentation for the proc STATDIS dealing with the parameter INVAL for further information). Such pixels cannot be distinguished from those flagged as "invalid" because of range restrictions which are described later. LOGF will display the number of pixels with such errors, if any have occurred, at the end of its processing. With the use of an appropriate blotch or values for RANGE, the responsible pixels may be excluded from the calculations. However, these

arithmetic errors may indicate that your values for CONST and other input parameters are incorrect and should be changed.

(3) CONST is a number by which the logarithm of each pixel will be multiplied as shown in equation (1).

(4) MODE is a flag which indicates whether the pixel values of the IN_FILE image represents data (such as temperature or radiance) that are linearly related to gray levels, or pigment concentrations which are non-linear. A "1" should be entered for linear data and a "2" for pigment data.

(5) FACTOR is a linear scale factor used only if MODE=1, i.e. when a linear data-to-gray scale mapping function for the IN_FILE image is used. If non-zero, it will represent the factor by which to divide the gray values of IN_FILE pixels in order to convert them into actual data values; if zero, the slope and intercept for this mapping function will be obtained from the file header of the IN_FILE disk image file. In order to retain the gray values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(6) RANGE defines the range of IN_FILE pixel values to use for the computation in equation (1). The user should enter two values in the input data units. For a given pixel location, if an IN_FILE value falls outside the RANGE values, the corresponding pixel in OUT_FILE will be flagged as "invalid." These "invalid" pixels may be assigned any value when using STATDIS to generate the image from OUT_FILE. Again, the RANGE values must conform to the units of the IN_FILE image as specified by MODE and FACTOR (i.e. pigment concentration or units linearly proportional to gray levels). For example, to exclude only land and cloud pixels, the RANGE values should be 1.0 and 254.0 (the default values) for gray levels (MODE=1 and FACTOR=1) or 0.0425 and 39.0 for pigment concentrations (MODE=2).

(7) OUT_FILE is the name for the "data" file output to the disk. This file is composed of floating point numbers for higher accuracy than if integers. The extension ".DAT" will be used by default if it is omitted from the file name. OUT_FILE must be used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. Note, however, that the same blotch specification used in LOGF will be needed by STATDIS (i.e., the same blotch must be used unless BPLANE=0). "Data" files such as OUT_FILE cannot be dropped directly into the image display unit as images or used as input to this proc. STATDIS must be used to generate and save image files from "data" files. In this way, you can interactively obtain, using STATDIS, an optimum gray scale for the image file corresponding to the range or subrange of data values in the "data" file. By convention, "data" file names end with the extension ".DAT" whereas image file names end with ".IMG". Note that the disk space required by a "data" file is proportional to the blotch area and may be much more than that required by an image file which is always

513 blocks. For a full image (BPLANE=0, the equivalent of a full-image blotch), a "data" file will require 2049 blocks or about four times the space of an image file; for a blotch covering less than a quarter of the image, however, the "data" file will be smaller than an image file.

(8) BPLANE defines the number of the graphics plane containing the blotch area(s) of interest and is in the range -7 to 7. If the number entered is positive, pixels within the blotch will be considered. If the number is negative, pixels outside the blotch will be considered. Only blotches defined on this plane (the absolute value of BPLANE) of the blotch file BLO_FILE will be used. If "0" is entered, the entire image area (512 x 512) will be used and BLO_FILE will be ignored.

(9) BLO_FILE is the name of the blotch file which defines the image area(s) of interest unless BPLANE = 0. Only blotches defined on the plane corresponding to BPLANE will be used. Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. The extension ".BLO" will be used by default if it is omitted from the file name.

**IIS BUTTON DEFINITIONS:**

No IIS buttons are required in this proc.

**PROGRAM NAME:** LOO
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** Proc LOO simulates a movie loop by displaying a specified set of refresh memories, one after the other in the order in which they are input. The length of time that each memory frame is displayed can be controlled by the user.

**PARAMETERS:**

(1) TIME represents the time in milliseconds to pause on each frame. The parameter range is from 0 to 10000. thus:

TIME=1 equivalent to 1 millisecond
TIME=2 equivalent to 2 milliseconds
:
:
TIME=10000 equivalent to 10 seconds

(2) CHANNEL gives the numbers of the refresh memories to loop through. The parameter accepts up to 14 values, each of which correspond to the channel desired ( 1=channel 1, 2=channel 2, etc.). The acceptable values are:

1 -- loop memory 1
2 -- loop memory 2
.
.
.
14 -- loop memory 14

EX: CHANNEL = (1,6) loops through channels 1 and 6
CHANNEL = (1,2,3,5,4,6,8,3) loops through the channels in that order
CHANNEL = (2,1) loops through channels 1 and 2

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | | | | | Exit |
| 2 | | | | | Change Loop Interval |
| 1 | | | | | Change Loop Sequence |

F1: Allows one to change the looping sequence of the channels. The parameter requested is CHANNEL and performs the same as defined above.

F2: Allows one to change the time interval. The parameter TIME is requested by this button. TIME functions as defined above.

F3: This button exits LOO and returns the user to SEAPAK.

**PROGRAM NAME:** LUTMAP
**DATE:** 4/15/91
**MENU:** LUT

**DESCRIPTION:** Program LUTMAP plots a graph of the mappings defined in the enabled look-up table(s) of the specified refresh memory. The output graph plots "Pixel Values" versus "Gray Level Mappings". This essentially gives one a graphic presentation of color value at different counts for a "gun". By cycling through each gun, one could determine the "color mix" at each count. It should be noted that graphics planes 1,2 and 4 are used by this program. Thus these planes will be cleared when this program is executed and whatever one had there will be erased.

**PARAMETERS:**

(1) CHANNEL defines the number of the refresh memory whose LUT(s) are to be graphed. This parameter accepts one of the following values:

1 selects CHANNEL 1 (DEFAULT)
2 selects CHANNEL 2
3 selects CHANNEL 3
.
.
.
14 selects CHANNEL 14 (the highest channel number that can be examined)

(2) COLOR specifies which Look-Up Table (LUT) is to be mapped. There are 3 acceptable values for this parameter:

COLOR=RED (default) indicates that the red look-up table will be mapped
COLOR=GREEN indicates that the green lut will be mapped
COLOR=BLUE indicates that the blue lut will be mapped

Note: Any subset of the strings may be entered (ex: CO=R)

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** LUTMOD
**DATE:** 8/25/88
**MENU:** LUT

**DESCRIPTION:** Program LUTMOD allows you to change the brightness and contrast of the displayed image by modifying the look-up tables. Any interval of pixel values between 0 and 255 may be selected and assigned a different range of output values (gray levels). Through successive iterations of the program, a piecewise linear function can be generated in the LUT. The capabilities of this program make it useful for a variety of tasks other than normal image enhancement, which can often be done as readily using STRETCHT or PLI. One common use for this program is to force the clouds of a CZCS level 2 pigment scene to be white. Clouds will sometimes come out black depending on how the land and cloud mask flags were set in L2GEN. This program allows the user to set black (zero) values to 255. One must remember that the change is only in the LUT, and thus this image must be FEED to another memory to save it with these values.

**PARAMETERS:**

(1) CHANNEL is the number of the refresh memory containing the LUT to be modified. This parameter accepts one of the following values:

1 - CHANNEL 1
2 - CHANNEL 2
3 - CHANNEL 3
:
14 - CHANNEL 14

(2) MOD defines the starting and ending input pixel values and the starting and ending output (gray level) values for the selected range. In otherwords, the MOD parameter expects four values as follows:

MOD = (p1,p2,p3,p4)

Where: p1 = starting input pixel value
p2 = ending input pixel value
p3 = starting output (gray level) value
p4 = ending output (gray level) value

EX: MOD = (100,200,200,255) means that the pixel values from 100 to 200 are displayed as gray levels from 200 to 255.

MOD = (0,64,0,255) means that six bits of information is "stretched" to use the full dynamic range (8 bits) of the display.

(3) COLOR indicates which Look-Up Table(s), Red, Green or Blue, to modify. This parameter accepts up to 3 values:

EX: COLOR=(RED,GREEN,BLUE) means the red, green and blue look-up tables will each be modified equally (this is the default and keeps the image black and white rather than colored).

COLOR=GREEN means that the green LUT will be modified.

COLOR=(BL,RE) means that the blue and red luts will be modified (Note that the right-hand characters of the color names can be truncated).

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Modify LUT | Plot Pixel/Gray Level Map | Erase Graph | List Pixel/Gray Level Map | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button allows one to modify the LUT. The input parameters requested are CHANNEL, MOD and COLOR and are defined as above.
B3: A plot of the pixel/gray level map is made.
C3: The graph generated using B3 can be erased with this button.
D3: The pixel/gray level map can be listed on the user's terminal with this button.
F3: LUTMOD is terminated and the user is returned to SEAPAK.

**PROGRAM NAME:** MAPIMG
**DATE:** 4/15/91
**MENU:** GEOGRAPHIC

**DESCRIPTION:** This proc will project unmapped images into any of 20 specified map projections. A list of these projections is provided under the description for the parameter PROJECTN. Many parameters are common to all the projections, but some are projection dependent. The user is prompted for these latter parameters after the projection has been selected and RUN has been executed in the TAE menu. Note however, that the option exists to run this proc in a non-interactive or batch mode using a parameter file given by the parameter DYNNAME. The procedure to do this is described in this parameter's description in the next section. Parameters are provided for controlling various aspects of the projections, e.g. the location of a landmark on the projected images can be specified via its latitude/longitude, or the horizontal and vertical scales can be controlled (magnification or reduction). The program will normally require several minutes to run.

The USGS General Cartographic Transformation Package (GCTP) is used for the map projection transformation equations. For additional information on projections, methodology, and terminology see Snyder (1982). A discussion on the use of MAPIMG is included in a separate chapter in Volume I of this guide.

**PARAMETERS:**

(1) INFILE are the names of disk files containing the images to be mapped. The images must be registered, umapped SEAPAK images. The number of INFILE names must match that of OUTFILE. The extension ".IMG" will be used by default if it is omitted from a file name.

(2) OUTFILE are the names of the disk files to create for the projected images. All output files will have the same projection characteristics and will be registered. Since the resulting projection for each INFILE will be output to the corresponding OUTFILE, the number of OUTFILE names must match that of INFILE. The extension ".IMG" will be used by default if it is omitted from a file name.

(3) PROJECTN indicates the projection to use in mapping the images. A number in the range of 1 to 20, corresponding to any of the following projections, must be entered:

1 Universal Transverse Mercator (UTM)
2 State Plane Coordinates (SPC)
3 Albers Conical Equal-Area
4 Lambert Conformal Conic
5 Mercator
6 Polar Stereographic
7 Polyconic
8 Equidistant Conic
9 Transverse Mercator

10 Stereographic
11 Lambert Azimuthal Equal-Area
12 Azimuthal Equidistant
13 Gnomonic
14 Orthographic
15 General Vertical Near-Side Perspective
16 Sinusoidal
17 Equirectangular
18 Miller Cylindrical
19 Van der Griten
20 Oblique Mercator

After the program starts, one will be prompted for additional information depending on the projection chosen.

(4) LL_1 is the latitude/longitude (in decimal degrees) of point 1 which is to appear at a specified PIXEL/LINE location of the projected images. The points defined by LL_1 and LL_2 will appear DELTA_P (vertical or horizontal) pixels apart. Unlike LL_1, the point at LL_2 need not even be one which is expected to appear in the output images. These points must have some vertical and horizontal separation in the projected images.

LL_1, LL_2, PIXEL, LINE, and DELTA_P are used to determine the scale (i.e., meters per pixel/line) of the projected images as well as the area of the earth's surface to appear within the image boundaries. If the null value "--" (default) is entered for any of these parameters or only one value is entered for LL_1 or LL_2, a default scale will be used such that the entire input images appear within the output image limits. In this case, the output images will be top- and left-adjusted and the entire pixel or line range will be used.

(5) LL_2 is the latitude/longitude (in decimal degrees) of a second point. As was mentioned above, the points defined by LL_1 and LL_2 will be DELTA_P (vertical or horizontal) pixels apart and, unlike LL_1, the point at LL_2 need not be one which is expected to appear in the output images.

(6) PIXEL is the (horizontal) pixel position at which the point defined by LL_1 is to appear in the projected images. Note that, for the IIS display, the left edge is considered as pixel 1.

(7) LINE is the line position at which you would like the point defined by LL_1 to appear in the projected images. Note that, for the IIS display, the top edge of the display is considered as line 1.

(8) DELTA_P is the separation in pixels on the projected images of the points defined by LL_1 and LL_2. If DELTA_P is positive, it will be used as the horizontal separation of the two points; if negative, it will be used as the vertical separation. Note that the sign of DELTA_P does not otherwise imply anything about the relative positions of the two points.

Although LL_2 need not be in the output images, DELTA_P must still represent the horizontal or vertical separation in

pixels. This therefore means that DELTA_P may be greater than the pixel width or height of the output images. For a given LL_1/LL_2, a larger DELTA_P will cause a magnification, i.e. increase the projection scale resulting in more pixels per earth meter.

(9) ASPECT represents the Y-over-X aspect ratio of the output images. It may be used to change the scale in one direction relative to the other. An ASPECT>1 causes vertical stretching whereas an ASPECT<1(but greater than zero) causes horizontal stretching.

It should be noted that, if ASPECT is not equal to 1 (the default value), certain characteristics which are part of a projection's definition may be changed. The projection of the output images would then not be strictly that which you specify with PROJECTN. Therefore, an ASPECT value different from 1 should be used only for special purposes.

(10) PROGRESS is a parameter indicating whether or not to display program progress. A "YES" should be entered if one would like the program to display messages at certain intervals to indicate the progress of the processing.

(11) DYNNAME is the name of a parameter file containing the responses to a dynamic tutor. It should be recalled that after MAPIMG is invoked, it requires values to a set of parameters which depend on the PROJECTN specified. If MAPIMG is being run interactively and DYNNAME is blank or the null value (default), one will be prompted for the parameter values via a dynamic tutor session. Default values based on the INFILE image and the PROJECTN value will be suggested for those parameters. If MAPIMG is being run as a batch job and DYNNAME is blank, the default values will be used automatically for the required parameters. However, you may enter for DYNNAME the name of a parameter file from which to obtain the values for all parameters used in that dynamic tutor session. A disk and directory path may be explicitly specified with the name; otherwise, the current disk or directory is assumed. The default filename extension is ".PAR". One may create such a parameter file by: 1) running MAPIMG interactively with DYNNAME="--" until the dynamic tutor is invoked, 2) entering the desired values for each tutor menu item, 3) using the SAVE command, and then 4) typing EXIT so as not to continue with the execution of MAPIMG. The parameter entered for the SAVE command is used for the parameter file name. If no name is entered, a default name, made up of the name of the TAE PDF containing the dynamic tutor parameters and the extension ".PAR", is used and the parameter file is created in the current directory. For MAPIMG, the PDF is called "MAPIMGDYN.PDF" and the corresponding DYNNAME would thus be "MAPIMGDYN".

**DYNAMIC PARAMETERS:**

After the previous parameters have been selected and "RUN" has been entered, and if DYNNAME is null, the user will be prompted for more

parameters depending upon the choice for a projection. The list of all the parameters with their definitions are given below. The user will not be prompted for all these parameters for any one projection.

(1) ZONE has two uses depending on the projection that calls for it. If PROJECTN=1, ZONE is the UTM zone. The default value is the zone for the default value of LONG. If one enters a different ZONE, the value entered will be used. If one enters a different LONG, the zone for that longitude will be used if ZONE was not changed. If PROJECTN=2, ZONE is the SPC zone.

(2) LAT is the value of the latitude (in decimal degrees) of any point in the image. The default value is the latitudinal midpoint of the unmapped image.

(3) LONG is the value of the longitude (in decimal degrees) of any point in the image. The default value is the longitudinal midpoint of the unmapped image. LONG may be used to determine the UTM zone of the projection (see ZONE).

(4) SPHEROID specifies the standard Earth spheroid to use. Clarke 1866 is the default. The following integers with their corresponding spheroid are allowable entries:

| | | | |
|---|---|---|---|
| 1: | Clarke 1866; | 2: | Clarke 1880; |
| 3: | Bessel; | 4: | New International 1967; |
| 5: | International 1909; | 6: | WGS 72; |
| 7: | Everest; | 8: | WGS 66; |
| 9: | GRS 1980; | 10: | Airy; |
| 11: | Modified Everest; | 12: | Modified Airy; |
| 13: | Walbeck; | 14: | Southeast Asia; |
| 15: | Australian National; | 16: | Krassovsky; |
| 17: | Hough; | 18: | Mercury 1960; |
| 19: | Modified Mercury 1968; | 20: | Sphere of R=6370997m |

To use another spheroid, enter SPHEROID=0 and the desired values for MAJOR and MINOR.

(5) MAJOR is the semi-major axis for the desired spheroid in meters. If one inputs SPHEROID=0, then a value for this parameter must be entered along with a value for MINOR (the semi-minor axis). The default value is the semi-major axis of the Clarke 1866 spheroid (SPHEROID=1) in meters.

(6) MINOR is the semi-minor axis for the desired spheroid in meters when SPHEROID=0. A value for MAJOR (the semi-major axis) must also be entered for this case. If MINOR=0 or MINOR=MAJOR and SPHEROID=0, a sphere of radius MAJOR will be used.

The default value is the eccentricity squared of the Clarke 1866 spheroid (the default spheroid, SPHEROID=1). The eccentricity squared (e2) is determined from:

e2 = 2f - f**2,

where f (the flattening) = 1 - (semi-minor axis/semi-major axis).

(7) RADIUS is the Earth's radius in meters. The default value is 6,370,997 meters.

(8) LAT_0 is specific to the projection being utilized, but in all cases is to be entered in decimal degrees.

If PROJECTN is 3, 4, 7, 8, 9, or 20, it represents the latitude of the projection origin. For PROJECTN=20, the default value is the latitudinal midpoint of INFILE; otherwise, it is the INFILE latitude closest to the equator.

If PROJECTN is 5, 6, or 17, LAT_0 is the standard parallel (latitude of true scale). The default is the latitudinal midpoint of INFILE.

If PROJECTN is 10, 11, 12, 13, 14, or 15, it is the latitude at the center of the projection. The default value in all these cases is the latitudinal midpoint of INFILE.

If PROJECTN is 1, 2,16, 18, or 19, LAT_0 is not used.

(9) LONG_0, for all projections except PROJECTN=20, is the longitude of the central meridian. The value entered should be in decimal degrees. The default value is the longitudinal midpoint of INFILE.

For PROJECTN=20, this parameter is used only if FLAG=1. The longitude of the point on the center line where AZIMUTH is measured should be entered. Since the default is FLAG=0, the default LONG_0 is zero for this case.

(10) LAT_1 is specific to the projection being utilized, but in all cases is to be entered in decimal degrees.

If PROJECTN is 3, 4, or 8, the latitude of the first standard parallel should be entered. For PROJECTN=8, a second standard parallel is required if FLAG=1 (default). The default value is the latitude at 1/6th of the input image from its northernmost point. If the equator is in the input image and the northernmost point is at a smaller absolute latitude than the southernmost point, the default is the latitude at 2/6th the input image from its northernmost point.

If PROJECTN=20, LAT_1 is only used if FLAG=0 (default). It then represents the latitude of the first point used to define the center line. The default value is the northernmost point of the input image.

LAT_1 is not used in the other projections.

(11) LONG_1 is only used if FLAG=0 (default) and represents the longitude (in decimal degrees) of the first point used to define the center line. The default value is the longitudinal midpoint of the input image.

(12) LAT_2 is specific to the projection being utilized, but in all cases is to be entered in decimal degrees.

If PROJECTN is 3, 4, or 8, one should enter the latitude of the second standard parallel. For PROJECTN=8, this second standard parallel is used only if FLAG=1 (default). The default value is the latitude at 1/6th of the input image from its southernmost point. If the equator is in the input image and the southernmost point is at a greater, or equal, absolute latitude than the northernmost point, the default is the latitude at 2/6th the input image from its southernmost point.

If PROJECTN=20, LAT_2 is only used if FLAG=0 (default) and represents the latitude of the second point used to define the center line. The default value is the southernmost point of the input image.

LAT_2 is not used in the other projections.

(13) LONG_2 is only used if FLAG=0 (default) and represents the longitude (in decimal degrees) of the second point used to define the center line. The default value is the longitudinal midpoint of the input image.

(14) SCALE is the projected image's central scale factor. The default value is 0.9996.

(15) HEIGHT is the height of the perspective point above the Earth's surface in meters. This parameter is used only for the General Vertical Near-Side Projection (PROJECTN=15). The default value is 950,000 meters which is the nominal altitude of the Nimbus 7 satellite.

(16) AZIMUTH is the azimuth angle (east of north) for the center line. This parameter is used only if FLAG=1 (The default is FLAG=0).

(17) FLAG is a parameter which is used only if PROJECTN is 8 (Equidistant Conic) or 20 (Oblique Mercator).

If PROJECTN=8, one should enter a "0" if one standard parallel is being specified or a "1" (the default), if two are being specified. See LAT_1, LONG_1, LAT_2, and LONG_2 for more clarification. Standard parallels are true to scale and free of angular distortion.

If PROJECTN=20, one should enter a "0" (the default) if one is defining the center line (which determines the obliqueness of the Oblique Mercator projection) by using the coordinates of two points in the image (LAT_1/LONG_1 and LAT_2/LONG_2) or a "1" if you are using the azimuth angle (AZIMUTH) at a point (LONG_0) to define the center line.

**IIS BUTTON DEFINITIONS:**

No buttons are used in this proc.

**PROGRAM NAME:** MARK
**DATE:** 4/15/91
**MENU:** CURSOR

**DESCRIPTION:** The program MARK provides the user with the ability to determine the gray level value and X/Y coordinates of a selected pixel for a single channel image. After a pixel has been selected using the cursor and the A3 button is depressed, the desired information is displayed outside a small box which is plotted around the pixel, with the pixel value written just above this box and the X and Y coordinates written just below. Using the IIS buttons, one can erase the values which are displayed or toggle them on or off. A typical plot of the information that MARK returns looks like this:

```
        103        <--- Pixel value
        ---
        | |        <--- Closed box around pixel
        ---
     (304,282)     <--- (X,Y) coordinates
```

**PARAMETERS:**

(1) CHANNEL selects the refresh memory channel to be examined and displayed. If another memory is being displayed on the monitor when MARK is executed, it is automatically replaced by the refresh memory selected by CHANNEL before any pixels are examined.

(2) GBITPL is the number of the overlay bit plane where the box and pixel value/coordinates are shown. The bit planes are numbered from 1 to 7. Plane 1 is the default plane that MARK uses.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Examine Image | Toggle Graphics On/Off | Erase Last | Erase All | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: Depressing this button, allows one to examine the pixel under the cursor. The pixel value and coordinates will be displayed.

B3: This button allows one to toggle the graphics plane on and off.

C3: The graphics associated with the last pixel examined can be erased using this button.

D3: The graphics plane with the displayed output will be erased by this button.

F3: This button terminates MARK and returns the user to SEAPAK.

**PROGRAM NAME:** MEANF
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc may be used to average disk image files, pixel by pixel, according to the following general equation:

OUT = C + sum[ W(n)*I(n)**E(n) ] / N

for n = 1 to NUM, where OUT is the output data file designated by the parameter OUT_FILE, C corresponds to the constant CONST, W are the weights WEIGHT, I are the image data from the files IN_FILES, E are the exponents EXPON, N is the number of values summed and NUM is the number of IN_FILES. The region of interest within the image may be limited by specifying a blotch plane (BPLANE and BLO_FILE). One can limit the calculations only to the areas within or outside of this blotch. MEANF converts the integer numbers of IN_FILES to floating point for its arithmetic operations and hence maintains excellent accuracy. Consequently, OUT_FILE is used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. For a given pixel, if all I(n) values fall outside the RANGE values, or if an arithmetic error occurs during summation, OUT for that pixel will be flagged as "invalid" and subsequently assigned a value that is specified in the proc STATDIS.

**PARAMETERS:**

(1) IN_FILES are the names of the disk resident input image files one wants to process (the I(n) in equation (1) above). The extension ".IMG" will be used by default if it is omitted from a file name. The number of names entered must be the same as the number of WEIGHT's and EXPON's. The files must be image data files such as those produced by the procs TODISK and STATDIS (i.e., they contain 513 blocks, one of which is a header block). The files must also be for images of the same type of data (see the description for MODE).

(2) WEIGHT are the weighting factors for IN_FILES. A number must be entered for each IN_FILES. Each number will be used as a multiplicative factor for the pixel values of its corresponding image (raised to the EXPON power) during summation. Equation (1) above shows how W(n) or WEIGHT multiplies the input images. To illustrate the use, consider the following examples:

1) for simple averaging, set C=0, W(n)=1, and E(n)=1;
2) to raise an image (NUM=1) to the X power, set C=0, W(1)=1 and E(1)=X.

(3) EXPON are the exponents for IN_FILES. A number must be entered for each IN_FILES. Each number will be used as the power by which to raise the pixel values of its corresponding image

during summation. Equation (1) above shows how E(n) or EXPON raises the image to a power. Note that EXPON's not equal to one will affect the units of their respective terms. It is the user's responsibility to ensure that the final units of terms are consistent. Arithmetic errors may occur during summation if inappropriate EXPON values are used. For example, errors will occur if EXPON's are too large or too small, or if negative EXPON's are used with zero or negative input image pixel values. Output data values of pixels for which arithmetic errors have occurred will be flagged as "invalid" and may be assigned any desired value when using the proc STATDIS. (See the documentation for the proc STATDIS dealing with the parameter INVAL for further information). Such pixels cannot be distinguished from those flagged as "invalid" because of range restrictions which are described later. MEANF will display the number of pixels with such errors, if any have occurred, at the end of its processing. With the use of an appropriate blotch or values for RANGE, the responsible pixels may be excluded from the calculations. However, these arithmetic errors may indicate that your values for EXPON and other input parameters are incorrect and should be changed.

(4) CONST is a constant (in output data units) which is to be added to the sum of the terms as shown in equation (1). The user should enter a real number whose units match those of the other terms.

(5) MODE is a flag which indicates whether the pixel values of the IN_FILES image(s) represent data (such as temperature or radiance) that are linearly related to gray levels, or pigment concentrations which are non-linear. A "1" should be entered for linear data and a "2" for pigment data.

(6) FACTOR is a linear scale factor used only if MODE=1, i.e. when a linear data-to-gray scale mapping function for the IN_FILES image(s) is used. If greater than zero, it will represent the factor by which to divide the gray values of IN_FILES pixels in order to convert them into actual data values; if zero or less, the slope and intercept for this mapping function will be obtained from each file header of the IN_FILES disk image files. In order to retain the gray values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(7) RANGE defines the range of IN_FILES pixel values to use for the summation in equation (1). The user should enter two values in the input data units. For a given pixel location, if values for all IN_FILES fall outside the RANGE values, the corresponding pixel in OUT_FILE will be flagged as "invalid." These "invalid" pixels may be assigned any value when using STATDIS to generate the image from OUT_FILE. Again, the RANGE values must conform to the units of the IN_FILES image(s) as specified by MODE and FACTOR (i.e. pigment concentration or units linearly proportional to gray levels). For example, to

exclude only land and cloud pixels, the RANGE values should be 1.0 and 254.0 (the default values) for gray levels (MODE=1 and FACTOR=1) or 0.0425 and 39.0 for pigment concentrations (MODE=2).

(8) OUT_FILE is the name for the "data" file output to the disk. This file is composed of floating point numbers for higher accuracy than integers. The extension ".DAT" will be used by default if it is omitted from the file name. OUT_FILE may be used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. Note, however, that the same blotch specification used in MEANF will be needed by STATDIS (i.e., the same blotch must be used unless BPLANE=0). "Data" files such as OUT_FILE cannot be dropped directly into the image display unit as images or used as input to this proc. STATDIS must be used to generate and save image files from "data" files. In this way, you can interactively obtain, using STATDIS, an optimum gray scale for the image file corresponding to the range or subrange of data values in the "data" file. By convention, "data" file names end with the extension ".DAT" whereas image file names end with ".IMG". Note that the disk space required by a "data" file is proportional to the blotch area and may be much more than that required by an image file which is always 513 blocks. For a full image (BPLANE=0, the equivalent of a full-image blotch), a "data" file will require 2049 blocks or about four times the space of an image file; for a blotch covering less than a quarter of the image, however, the "data" file will be smaller than an image file.

(9) BPLANE defines the number of the graphics plane containing the blotch area(s) of interest and is in the range -7 to 7. If the number entered is positive, pixels within the blotch will be considered. If the number is negative, pixels outside the blotch will be considered. Only blotches defined on this plane (the absolute value of BPLANE) of the blotch file BLO_FILE will be used. If "0" is entered, the entire image area (512 x 512) will be used and BLO_FILE will be ignored.

(10) BLO_FILE is the name of the blotch file which defines the image area(s) of interest unless BPLANE = 0. Only blotches defined on the plane corresponding to BPLANE will be used. Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. The extension ".BLO" will be used by default if it is omitted from the file name.

**IIS BUTTON DEFINITIONS:**

No buttons are used in this proc.

**PROGRAM NAME:** MEANPROF
**DATE:** 4/15/91
**MENU:** UNGRIDANL

**DESCRIPTION:** This program is used for generating a mean profile from SEAPAK hydrographic data listings and putting the output in a form recognizable by Golden Software Inc.'s Grapher software. Grapher can plot the vertical profile using the mean profile as input. Currently supported inputs include ASCII files created by the station data (RDNODCSD, RDNCSDBA), Skidaway (RDSKDWAY, RDSKDBA), XBT (RDXBT, RDXBTBA) and Southern Ocean Atlas (RDSOADS) listing programs within SEAPAK. Note that the inputs can be either a single file created by the batch version of these programs, or multiple files created from the interactive versions. Data selection from the input profiles is controlled by input parameters such as: START and END for time ranges, WNES for spatial specifications, DRNG for data value ranges, ZRNG for depth ranges and REQPRM to request a parameter's name. The vertical spacing or resolution of the mean output profile is determined by parameter DELTZ, the vertical cell size. The output is an ASCII file in Grapher spreadsheet format. The output contains columns for each vertical cell level, respectively from left to right: mid-level depth value, mean parameter value within that cell, minimum value, maximum value, standard deviation, mean latitude, mean longitude, number of samples and number of profiles.

**PARAMETERS:**

(1) INFN is the input file name(s). These can be ASCII files created by any of the following programs:

RDNODCSD, RDNCSDBA (station data)
RDSKDWAY, RDSKDBA (Skidaway data)
RDXBT, RDXBTBA (XBT data)
RDSOADS (Southern Ocean Atlas)

NOTE: Even though there is an upper limit of 50 files which can be specified (due to a restriction imposed by the Transportable Applications Executive, TAE), there is no limit to the total number of profiles within these files which can be ingested.

(2) OUTFN is the output file name for the mean profile. The format for this output ASCII file is:

Column 1: Mid-level depth in meters
2: Parameter value (mean)
3: Minimum value of samples used to compute mean
4: Maximum value of samples used to compute mean
5: Standard deviation of samples used to compute mean
6: Mean latitude in degrees of samples used to compute mean

7: Mean longitude in degrees of samples used to compute mean

8: Number of samples (i.e. total number of levels) over all input profiles used to compute the mean for each output profile level.

9: Number of input profiles used in computing mean at each specific output level.

Note: The value for missing data is 99999.0.

(3) START is the start time for the gathering of data to be used in computing the mean profile. START(1) is in the form YYMMDD (year/month/day). START(2) is in the form HHMMSS (hour/minute/second). Data outside the range defined by START and END will be ignored. Note that START must be less than or equal to END. Taking the default of zero for both START and END results in all of the profiles from INFN becoming valid (no filtering based on time will be done).

(4) END is the ending time for the gathering of data to be used in computing the mean profile. END(1) is in the form YYMMDD (year/month/day). END(2) is in the form HHMMSS (hour/minute/second). Data outside the range defined by START and END will be ignored. Note that END must be greater than or equal to START. Taking the default of zero for both START and END results in all of the profiles from INFN becoming valid (no filtering based on time will be done).

(5) WNES is the spatial range for the input profiles to be read in computing the mean profile. WNES(1) is the westernmost longitude, WNES(2) is the northernmost latitude, WNES(3) is the easternmost longitude. WNES(4) is the southernmost latitude (all in degrees). Profiles falling outside of the range defined by WNES will not be used in computing the mean profile.

(6) DTYPE is the data type for the profiles read during the program run (this applies to all profiles). Specify a value of "1" if the data is meteorological (all levels will be made positive so the mean profile has the lowest heights at the bottom) or "-1" if the data is oceanographic (all levels will be made negative so the mean profile has greatest depths at the bottom).

(7) REQPRM is the parameter from the input profiles for which the mean profile is to be computed. All of the input profiles should contain this parameter. REQPRM should be one of the following mnemonics:

HGHT for height (depth)
TEMP for temperature
SALI for salinity
SIGT for sigma-T
SDSP for sound speed
O2 for oxygen
IPHS for inorganic phosphorus
TPHS for total phosphorus

PHOS for phosphate
SILI for silicate
SIO3 for silicate
NTRI for nitrite
NTRA for nitrate
PH for pH
RECD for record number

(8) DRNG is the valid data range. Only data values falling into the range defined by DRNG will be included in the computation of the mean profile. If DRNG(1) = DRNG(2), no data values will be excluded (i.e. all will be valid).
(9) ZRNG is the valid depth range for the input profiles, in units of meters. Only depths falling into the range defined by ZRNG will be included in the computation of the mean profile. As an example, if you set ZRNG(1)=5.0, ZRNG(2)=-91.0 and DELTZ= 10.0, values for mid-level depth are: 0.0, -10.0, -20.0, -30.0, -40.0, -50.0, -60.0, -70.0, -80.0, and 90.0.
(10) DELTZ is the depth (height) increment in meters. This is the vertical spacing, or resolution (i.e. binning cell size) of levels in the mean profile.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** MEM
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc enables the user to obtain a power spectrum utilizing the maximum entropy method (MEM) for any region of a displayed image. The region is defined by the user (within this proc) on a graphics plane and may have the shape of a line, rectangle (with horizontal and vertical sides relative to the display), or parallelogram. After a power spectrum is calculated, it may be plotted or output to an ASCII file as a list of the X/Y (frequency/spectral density) values. The algorithm used for calculating the power spectrum is from Press et al. (1986). Further information on the algorithm may be obtained directly from this source.

**PARAMETERS:**

(1) MODE specifies whether the input data is linearly scaled or a pigment. A "1" (the default value) should be entered if the pixel values of the displayed image represent data that are linearly related to gray levels (such as radiance or temperature). A "2" should be entered if the data represents pigment concentrations (mg/m3).

(2) FACTOR is the linear conversion factor when MODE=1 and will be ignored for pigment input data. If FACTOR is positive, it will represent the factor by which to divide the gray values of the image pixels in order to convert them into actual data values. If a zero or negative number is entered, the slope and intercept for this mapping function will be obtained from the file header of the corresponding disk image file. Examples of specific values this parameter may assume are: 1) "1" (the default value) in order to retain the gray values; 2) "8" in order to obtain sea surface temperature (SST); 3) "85" in order to obtain water radiance data; and 4) "170" in order to obtain aerosol radiance data.

**IIS BUTTON DEFINITIONS:**
There are four sets of button definitions. There is the main one that is entered when the program begins, as well as three submenus which result from the action of button A3 of the main menu. The main menu will be described first with the others following. One should note that for most of the input parameters requested under the button menus, if a null value "--" is entered, no action will be taken and the button options will be reactivated after "RUN" is typed. Also, after a value has been entered for a parameter, this new value is used as the default for the remainder of the time in this proc.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define New Area | Erase Graphics Plane(s) | Turn Graphics Plane(s) ON/Off | Turn Displayed Image ON/OFF | Exit |
| 2 | Calculate Power Spectrum | Plot Power Spectrum | Output Plot Data To File | | |
| 1 | | | | | |

A3: This button enables the user to define the area over which to perform the analysis. Input for two parameters, AREA and MARK_PL, are requested: AREA is the parameter which specifies the shape of the region to be analyzed, i.e. a line, box or a parallelogram. A button menu, corresponding to the choice made, will then be dropped. This then will allow the user to define the specific shape selected. These button submenus will be described after all of the main menu buttons have been described. A "0" should be entered if the area over which a power spectrum is to be obtained is a line. More than one line segment may be used in order to approximate a curved line. A "1" should be entered if the desired area is a "box" (a rectangle with horizontal and vertical sides, i.e. sides along the pixel or line direction). Only the top left and bottom right corners are needed to define the box (this will be evident when the button menu for this choice appears). If the area is to be a parallelogram, a "2" must be entered. Three corners will then need to be specified in a clockwise or counter-clockwise direction using the special submenu for this shape. Only the most recently defined area may be used for the MEM calculations (button A2). The initial default value is "2". As was mentioned, a new button menu, dependent on the value of AREA,will be displayed after "RUN" is typed. After marking the area of interest using this new button menu, pressing Exit (button F3) of the submenu returns the user to the regular MEM button menu. MARK_PL is the graphics plane to be used for delineating the area over which to calculate the power spectrum. A number in the range 1 to 7 needs to be entered. Note that any graphics on the specified plane will be retained when a new area is marked. To save the graphics plane(s) as a disk file after exiting MEM, use proc BPSAV. The initial default value is 1.

-A2: This button initiates the calculation of the power spectrum (button B2 plots the result). Three different sets of menus will prompt the user for the input parameters necessary for this calculation.

Parameters for the first set of prompts are DIRECTN, RANGE, DETREND and DIST. DIRECTN indicates along which direction to calculate the power spectrum (this is for a box or parallelogram only, i.e. AREA=1 or 2). A "1" is entered to indicate that the power spectrum is to be along the horizontal direction of a box or in the direction of the first defined side (i.e., between the first and second corners) of a parallelogram. (See AREA, button A3.) A "2" is entered to indicate that the power spectrum is to be along the vertical direction of a box or the second side of a parallelogram (between the second and third corners). This parameter refers to the most recently defined area. The initial default value is 1. RANGE specifies the range of pixel values over which the power spectrum is to be calculated, i.e. which pixels will be used. Two values conforming to the units of the image (i.e. pigment concentrations, gray levels or other linear scales) need to be entered. Pixels with values within this range, inclusively, will be used. The values of pixels outside the range will be replaced with an average of neighboring pixel values for the purposes of the MEM calculations. The initial default values are set so as to exclude absolute black or white pixels. DETREND indicates whether or not to detrend the data linearly before MEM calculations. A "YES" or "NO" should be entered as input. For box or parallelogram areas, each row of pixel data as specified by DIRECTN is detrended individually. A least squares fit through all the data in a row (or along a line in the case for AREA=0) is used to obtain the straight trend line. The initial default value is "YES". DIST is the distance between adjacent image pixels along the Earth's surface . This parameter is used to convert the power spectrum frequencies into units of cycles per unit distance. Therefore, if DIST=18 kilometers, the frequencies will be in cycles/km. The initial default value is 1.

Parameters for the second set of prompts are POLES, MIN_F and MAX_F. POLES represents the order of the maximum entropy method (MEM) approximation equation and, as such, its value should depend on the spectral characteristics of the data. The number of poles selected for the MEM calculations should be entered and be in the range of 1 to the number of pixels (N) minus 1 along the length of the area being studied. With larger POLES values, the spectral resolution of the power spectrum improves but spurious peaks may result and the computation time increases. As a compromise, the default value of 2*N/ln(2*N), calculated by the program, may be used. The following is from Press et al. (1986; pp. 433-434):

> In practice,...one usually wants to limit the [poles] to a few times the number of sharp spectral

features... With this restricted number of poles, the method will smooth the spectrum somewhat, but this is often a desirable property... If the number of poles or the number of data points is too large, roundoff error can be a problem... With "peaky" data (i.e. data with extremely sharp spectral features), the algorithm may suggest split peaks even at modest orders, and the peaks may shift with the phase of the sine wave. Also, with noisy input functions, if you choose too high an order, you will find spurious peaks galore! Some experts recommend the use of this algorithm in conjunction with more conservative methods, like periodograms, to help choose the correct model order, and to avoid getting too fooled by spurious spectral features.

MIN_F is the minimum frequency (cycles per unit distance) for the power spectrum. MIN_F may range from 0 to 0.5/DIST (the Nyquist frequency) but must be less than MAX_F. Note that the actual first frequency on the spectrum plot will be the first multiple of DELTA_F (see below) greater than or equal to MIN_F. The initial default value is 0. MAX_F is the maximum frequency (cycles per unit distance) for the power spectrum. MAX_F may range from 0 to 0.5/DIST (the Nyquist frequency) but must be greater than MIN_F. Note that the actual last frequency on the spectrum plot will be the first multiple of DELTA_F smaller than or equal to MAX_F. The initial default value is 0.5/DIST.

Only one parameter, DELTA_F, is requested for the third set of prompts. DELTA_F is the difference (in cycles per unit distance) between adjacent frequencies for the power spectrum. The default value of DELTA_F is either 0.5/999/DIST or (MAX_F-MIN_F)/299, whichever is greater. This default value represents the smallest value which you may use for DELTA_F. A larger value of DELTA_F saves computation time and may be adequate. Note that it is POLES, not DELTA_F, that determines the spectral resolution of the spectrum. However, DELTA_F should be small enough so that all peaks of interest are identifiable on the spectrum. After calculating the power spectrum, the total power of the spectrum and the variance of the input data will be displayed on the terminal. The total power is twice the sum of the spectral densities at the frequencies of the spectrum. These frequencies are all the multiples of DELTA_F from 0 to 0.5/DIST. Therefore, a power value much smaller than the variance indicates that significant peaks fell between spectrum frequencies and that a smaller DELTA_F should be used if possible.

B3: This button enables the user to selectively erase up to 7 graphics planes. The user is prompted for the parameter GRAPHICS which is just the number(s) of the plane(s) to erase. The input should be in the range 1 to 7. To turn planes off without erasing them, one must use button C3.

B2: Once the power spectrum has been calculated (with button A2), it can be plotted using this button. The plot can be displayed on various devices and annotated. Several parameters are used to determine specifically how the user chooses to display the plot. DEVICE designates the graphics device to be used for the graph of the power spectrum. The following character codes are the acceptable responses for the parameter at this time:

| | |
|---|---|
| II | IIS image display terminal |
| VT | VT240/VT241 retrographics terminal |
| CT | ColorTrend 4100 and Tektronics 4107 |
| HP | Hewlett-Packard plotter |

The initial default value is "II". COLOR is the color number (1 to 7) to use for the graph of the power spectrum. If DEVICE="II", COLOR corresponds to the IIS graphics plane to be used for the spectrum. This parameter may be used to generate several spectra on different planes. Note that a plane is not erased before a new graph is generated so as to allow the superimposition of spectra. To erase a plane, button B3 should be used. In order to save the graphics planes as a disk file after exiting MEM, the proc BPSAV should be utilized. The initial default value is 2. X_LAB consists of up to 45 characters which serve as the label for the X axis of the power spectrum graph. Upper and lower case letters and other characters may be used. The initial default label is "Frequency (cycles/km)"; subsequently, the previously entered label is used as the default. Note that the initial default label assumes that DIST is in kilometers. To enter a blank label, one must enclose a blank in double quotes. Y_LAB consists of up to 45 characters which serve as the label for the Y axis of the power spectrum graph. Upper and lower case letters and other characters may be used. The initial default label is "Spectral Density"; subsequently, the previously entered label is used as the default. Again, to enter a blank label, enclose a blank in double quotes. Y_SCALE is a flag indicating the type of scaling for the Y axis, i.e. linear or logarithmic. A "1" should be entered, if the power spectrum (Y axis) is to be in a linear scale. A "2" should be entered for a logarithmic scale. The initial default value is 1. TITLE consists of up to 73 characters which serve as the title and appear below the power spectrum graph. Upper and lower case letters and other characters may be used. The initial default title is "MEM POWER SPECTRUM"; subsequently, the previously entered title is used as the default. A blank enclosed in double quotes can also be used here to enter a blank title.

C3: The ability to turn selected graphics planes on/off is the function of this button. One responds to the parameter request of GPLANES by entering the number(s) 1 to 7 for up to 7 graphics planes to turn on or off. Specified planes which

are on will be turned off and those that are off will be turned on. Planes that are turned off are not erased (cleared) and may be turned back on with a subsequent use of this button. To erase graphics planes, use button B3.

C2: The output data for a power spectrum plot can be saved as an ASCII file using this button. The name for this file (OUT_FILE) is the only parameter requested. This file will contain the X values (frequencies) in the first column and the corresponding Y values (spectral densities) in the second column. Both columns are written in a FORTRAN 1PG15.7 format. The extension ".DAT" will be used by default if it is omitted from the file name.

D3: This button acts as a toggle, turning the image off when on and on when off.

F3: This button exits the proc.

Special buttons for A3 (of the main button menu) and AREA=0, i.e. a line:

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick New Vertex | | Draw Last Line Segment | Erase Last Line Segment | Exit |
| 2 | Erase New Vertex | | | | |
| 1 | | | | | |

A3: This button allows the user to choose the vertices of a line with multiple segments. After the cursor is moved to the beginning of the line, the button is depressed. The cursor is then moved to the next vertex and the button is pushed again, etc.

A2: This button allows one to erase the last vertex that was marked.

C3: After the beginning and endpoints of any segment are marked using A3, these points must be connected using this button. This defines all the points on this part of the line for the specified analysis. Thus the buttons A3 and C3 are used together to form a line with one or more segments.

D3: If one desires to erase the last line segment for any reason, this button provides that capability.

F3: This button initiates the drawing-of the requested diagram for the set of points specified by the line just defined and causes the main button menu to be dropped.

Special buttons for A3 (of the main button menu) and AREA=1, i.e. a box or rectangle:

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define Upper Left Corner | Define Lower Right Corner | Draw Area | Erase Area | Exit |
| 2 | Erase Upper Left Corner | Erase Lower Right Corner | | | |
| 1 | | | | | |

A3: The upper left corner of the box which defines the region of interest is designated using this button.

A2: The corner defined by button A3 can be erased. This allows the user to relocate the corner.

B3: The lower right corner of the box defining the region of interest is designated using this button.

B2: The corner defined by B3 can be erased with this button.

C3: This button draws the box defined by the two corners marked by A3 and B3 above. This then is the region which will be used for the analysis.

D3: This button erases the box drawn by C3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size of the box.

F3: This button initiates the drawing of the requested diagram for the set of points specified by the box just defined and causes the main button menu to be dropped.

Special buttons for A3 (of the main button menu) and AREA=2, i.e. a parallelogram:

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define First Corner | Define Second Corner | Define Third Corner | Display Parallel-ogram | Exit |
| 2 | Erase First Corner | Erase Second Corner | Erase Third Corner | Erase Parallel-ogram | |
| 1 | | | | | |

A3: The first corner of the parallelogram which defines the region of interest is designated using this button.
A2: The corner defined by button A3 can be erased.
B3: The second corner of the parallelogram defining the region of interest is designated using this button.
B2: The corner defined by B3 can be erased with this button.
C3: The third corner of the parallelogram defining the region of interest is designated using this button. These corners can be entered in either a clockwise or counterclockwise direction but consistency is assumed.
C2: The corner defined by C3 can be erased with this button.
D3: This button draws the parallelogram defined by the three corners marked by A3, B3 and C3 above. This then is the region which will be used for the analysis.
D2: This button erases the parallelogram drawn by D3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size or shape of the parallelogram.
F3: This button initiates the drawing of the requested diagram for the set of points defined within the parallelogram and causes the main button menu to be dropped.

**PROGRAM NAME:** MERGE
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** MERGE is a proc that allows one to concatenate up to five contiguous CZCS scenes. These images must not be mapped or have different orbit numbers. Since the total number of lines for an image cannot exceed 512, the program allows the user to specify a line subsampling factor to keep the final merged image within this limit. A scenario for using this proc would be the following:

1) Determine the start line number in the northernmost scene one is interested in (using CURREAD),
2) determine the total number of lines one wants to merge (again using CURREAD),
3) determine the subsampling or reduction factor required to encompass the desired area within one 512 line image,
4) use MERGE to make the merged scene from the input images.

**PARAMETERS:**
(1) IN is a list of the input files to be merged. This can include up to five contiguous scenes. The first file must be the northern most scene, the second the next most northern, etc.
(2) OUT is the name of the merged image.
(3) LINE is the line number in the first image at which the merging begins. This line number is given in terms of screen coordinates and becomes the first line of the merged image.
(4) REDL is the line sampling reduction factor, i.e. a value of 1 means to take every succeeding line, 2 means to take every other line, etc.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** MODHDR
**DATE:** 4/15/91
**MENU:** HEADER

**DESCRIPTION:** This program lets the user modify selected fields in up to 50 SEAPAK image headers. The fields can be selected from the following list:

1. Starting year
2. Starting Julian day
3. Center latitude from overview
4. Center longitude from overview
5. Corner latitudes from overview
6. Corner longitudes from overview
7. Start pixel
8. Start line
9. End pixel
10. End line
11. Slopes for any of the 6 bands
12. Intercepts for any of the 6 bands
13. Minimum latitude
14. Minimum longitude
15. Maximum latitude
16. Maximum longitude
17. Image corner latitudes
18. Image corner longitudes
19. Data source

The user specifies up to 50 SEAPAK image file names, and a list of 1-19 fields from the above list. Any of the image names can include wildcards, as long as the total number of images requested, including images represented by the wildcard entries, does not exceed 50. The user is then provided with the current values of these fields for each of the specified images, and can change them if they wish. If a value of -9999 (integer fields), -9999.0 (floating point fields) or "MM" (data source field) appears for a field, this means the image header could not be read and the user will not be able to modify the header for that image.

NOTE: this program should be used with EXTREME CAUTION since the user's changes will have obvious impacts on the results of other SEAPAK programs which use these fields. Only fields known to be in error should be changed.

**PARAMETERS:**

(1) IMAGES are up to 50 SEAPAK image filenames whose headers are to be modified. Wildcard inputs are acceptable for any of the 50 inputs, as long as the total number of filenames represented by IMAGES is no more than 50.

(2) FIELDS is a flag for each of the 19 header fields, indicating whether that field should be modified or not. Specify a 1 for

modifying a header field, or a 0 to leave it alone. All 19 entries for FIELDS must be specified.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** MOSAIC
**DATE:** 4/15/91
**MENU:** MOSAIC

**DESCRIPTION:** MOSAIC can be used to generate an image made up of selected parts of several other images. Specifically, this program creates a 512x512 mosaic from up to 10 SEAPAK images, each with its respective color look up table, file mask and gray level mask. In addition, one annotation graphics file containing up to seven graphics planes can be overlayed for annotation. The sequence of the mosaic generation is as follows:

1. Annotation, if it exists, overrides the image data. Each annotation graphics plane has a different priority as specified by the input sequence.
2. Each image file has a different priority. This is determined by the input sequence, the one specified first has the highest priority and so on.
3. Each image will be screened for output to the mosaic based on the file mask and the gray level masks associated with that specific image. Only pixels satisfying the masks will be recorded on the mosaic. When one input image is done, the next one will be screened. Now, however, the screening will only consider the blank portion of the mosaic. This sequence continues until all the input images have been processed.
4. The output is a 512x512x3 (3 band), 8 bit image. The first 512 blocks of data store the red components of the mosaic, the next 512 blocks of data store the green components of the mosaic and the last 512 blocks of data store the blue components of the mosaic.
5. To display this image, one must use RGBDIS (Note: IMAGE cannot be used for images generated under MOSAIC).

**PARAMETERS:**

(1) INFILE contains the input image file names. Up to ten file names can be entered. The input files should be 512x512 single band images with only one header block (in otherwords, standard SEAPAK single band images). The input sequence determines the priority in the output to the mosaic. The one entered first has the highest priority and is considered for the output to the mosaic first. The one entered second has the second priority and so on. Note that the annotation, when it exists, overrides the image data. The extension ".IMG" will be assumed if it is omitted.

(2) FMASK are the file masks for INFILE. One mask file can be entered for each INFILE specified. These files must be in the standard SEAPAK image format. The "on" pixels of the mask file specify the pixels in the corresponding input file to be considered for output to the mosaic image. An "on" pixel is one which satisfies the LOMASK/HIMASK criteria. If none of the input files have mask files, leave the parameter as a

default value (null). If only some of the input files do not have mask files, enter blank (i.e. " ") for their mask file names. The extension ".IMG" will be assumed if it is omitted.

(3) LOMASK specifies the lower bounds of the gray level masks for the corresponding INFILE. This parameter, along with HIMASK, allows one to mask directly utilizing the INFILES data values. This method can be used in addition to or in place of the image mask, FMASK. Thus one can mask: 1) using a gray level range on the image data directly, 2) using a special image file to define the mask, FMASK, or 3) using the two methods combined. When the the two methods are used in conjunction, only pixels which pass the FMASK checking will be screened with the bound checking. Either a positive or negative value can be entered for each element of LOMASK. The values entered should fall in the range of -255 to 255. If a positive value is entered, the corresponding HIMASK should be positive also. If a negative value is entered, the corresponding HIMASK should be negative also. A value of 0 is considered either positive or negative. The positive values specify an INCLUSIVE gray level range, i.e., only pixels of the corresponding input image file with gray levels within the specified range will be considered for output to the mosaic. On the other hand, the negative values specify an EXCLUSIVE gray level range, i.e. only pixels of the corresponding input image file with gray levels which fall outside the specified range will be considered for output to the mosaic. For example, if the bounds are (2,254), only pixels within 2 and 254 (including 2 and 254) will be output to the mosaic; if the bounds are (-2,-254), only pixels with gray level 0, 1 and 255 (excluding 2 and 254) will be output to the mosaic.

(4) HIMASK specifies the upper bound for a mask directly on the gray levels of the corresponding input data image, INFILES. Either a positive or negative value can be entered for each element depending on whether or not the corresponding value of LOMASK was positive or negative. As with LOMASK, the positive values specify an INCLUSIVE gray level range, i.e. only pixels of the corresponding input image file with gray levels which fall in the specified range will be considered for output to the mosaic. On the other hand, the negative values specify an EXCLUSIVE gray level range, i.e. only pixels of the corresponding input image file with gray levels which fall outside the specified range will be considered for output to the mosaic. The values entered should fall in the range of -255 to 255.

(5) LUTFIL is the file name for the lookup tables (LUT) which will be used with the data in the MOSAIC image. Whatever data from an INFILE that is used in the final MOSAIC image will have it's corresponding LUT applied to it. Valid host file names should be entered. The LUT files should be generated either by the program TABSAV or by the program PAINT. The extension ".LUT" will be assumed if it is omitted.

(6) ANNOTATE is the annotation file name. Enter a valid host file name, or if none is being used, the default null value should be retained. The annotation file should be generated by the program BPSAV or its equivalent.

(7) GPLANE is a parameter that defines on which graphics planes the annotation resides. The sequence entered determines the priority in the output if any happen to overlap. The one entered first has the highest priority followed by the second and so on.

(8) GCOLOR defines which colors will be associated with the corresponding graphic planes listed in GPLANE. The first color code entered corresponds to the first GPLANE specified, the second color entered corresponds to the second GPLANE specified and so on. The following is a list of available color codes :

| | | | |
|---|---|---|---|
| RE | red | PI | pink |
| GR | green | GY | gray |
| BL | blue | WH | white |
| YE | yellow | MA | magenta |
| CY | cyan | TA | tan |
| OR | orange | LG | light green |
| SA | sand | BK | black |
| BR | brown | | |

(9) MOSAIC is the output mosaic file name. A valid host file name should be entered. The extension ".RGB" will be assumed if it is omitted.

**IIS BUTTON DEFINITIONS:**

No buttons are used.

**PROGRAM NAME:** MULTF
**DATE:** 4/15/91
**MENU:** MATH

**DESCRIPTION:** This proc may be used to multiply disk image files, pixel by pixel, according to the following general equation:

OUT = AC + (MC * I1**E1 * I2**E2) (1)

where OUT is the output data designated by the file OUT_FILE, AC is an additive constant and corresponds to the parameter ACONST, MC is a multiplicative constant corresponding to the parameter MCONST, I1 and I2 are the image data from the files IN_FILES, and E1 and E2 are the exponents represented by the parameter EXPON. The region of interest within the image may be limited by specifying a blotch plane (BPLANE and BLO_FILE). One can limit the arithmetic only to the areas within or outside of this blotch. MULTF converts the integer numbers of IN_FILES to floating point for its arithmetic operations and hence maintains excellent accuracy. Consequently, OUT_FILE is used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. For a given pixel, if the I1 or I2 value falls outside the RANGE values, or if an arithmetic error occurs during calculation, OUT for that pixel will be flagged as "invalid" and subsequently assigned a value that is specified in the proc STATDIS.

**PARAMETERS:**

(1) IN_FILES are the names of the disk resident input image files one wants to process (the I1 and I2 in equation (1) above). The extension ".IMG" will be used by default if it is omitted from a file name. The number of names entered must be consistent with the other parameters entered. The files must be image data files such as those produced by the procs TODISK and STATDIS (i.e., they contain 513 blocks, one of which is a header block).

(2) EXPON are the exponents for IN_FILES. A number must be entered for each IN_FILES. Each number will be used as the power by which to raise the pixel values of its corresponding image prior to multipication. Equation (1) above shows how E1 or E2 (or EXPON) raises the images to a power. Note that EXPON's not equal to one will affect the units of their respective terms. It is the user's responsibility to ensure that the final units of terms are consistent. Arithmetic errors may occur during calculation if inappropriate EXPON values are used. For example, errors will occur if EXPON's are too large or too small, or if negative EXPON's are used with zero or negative input image pixel values. Output data values of pixels for which arithmetic errors have occurred will be flagged as "invalid" and may be assigned any desired value when using the proc STATDIS. (See the documentation for the proc STATDIS dealing with the parameter INVAL for further

information). Such pixels cannot be distinguished from those flagged as "invalid" because of range restrictions which are described later. MULTF will display the number of pixels with such errors, if any have occurred, at the end of its processing. With the use of an appropriate blotch or values for range, the responsible pixels may be excluded from the calculations. However, these arithmetic errors may indicate that your values for EXPON and other input parameters are incorrect and should be changed. For simple multiplication, set AC=0, MC=1, and E1=E2=1. For division, a negative EXPON makes the corresponding IN_FILES a divisor.

(3) ACONST is a constant (in output data units) which is to be added to the multiplication term as shown by AC in equation (1).

(4) MCONST is a real number by which to multiply the input images. This is shown in equation (1), where MC is the multiplicative constant MCONST.

(5) MODE is a flag which indicates whether the pixel values of the corresponding IN_FILES image represents data (such as temperature or radiance) that are linearly related to gray levels, or pigment concentrations which are non-linear. A "1" should be entered for linear data and a "2" for pigment data.

(6) FACTOR is a linear scale factor used only if MODE=1, i.e. when a linear data-to-gray scale mapping function for the corresponding IN_FILES image is used. If non-zero, it will represent the factor by which to divide the gray values of IN_FILES pixels in order to convert them into actual data values; if zero, the slope and intercept for this mapping function will be obtained from each file header of the IN_FILES disk image files. In order to retain the gray values, enter 1 (the default value); for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170.

(7) RANGE1 defines the range of IN_FILES(1) pixel values to use for the multiplication of equation (1). The user should enter two values in the input data units. For a given pixel location, if a value for IN_FILES(1) falls outside the RANGE1 values, the corresponding pixel in OUT_FILE will be flagged as "invalid." These "invalid" pixels may be assigned any value when using STATDIS to generate the image from OUT_FILE. Again, the RANGE1 values must conform to the units of the IN_FILES(1) image as specified by MODE(1) and FACTOR(1) (i.e. pigment concentration or units linearly proportional to gray levels). For example, to exclude pixels, the RANGE1 values should be 1.0 and 254.0 (the default values) for gray levels (MODE(1)=1 and FACTOR(1)=1) or 0.0425 and 39.0 for pigment concentrations (MODE(1)=2).

(8) RANGE2 is defined as is RANGE1 except it applies to IN_FILES(2) and its corresponding parameters.

(9) OUT_FILE is the name for the "data" file output to the disk. This file is composed of floating point numbers for higher accuracy than integers. The extension ".DAT" will be used by

default if it is omitted from the file name. OUT_FILE may be used as input to the proc STATDIS in order to generate its image, optimize its gray scale, and save it as a disk image file. Note, however, that the same blotch specification used in MULTF will be needed by STATDIS (i.e., the same blotch must be used unless BPLANE=0). "Data" files such as OUT_FILE cannot be dropped directly into the image display unit as images or used as input to this proc. STATDIS must be used to generate and save image files from "data" files. In this way, you can interactively obtain, using STATDIS, an optimum gray scale for the image file corresponding to the range or subrange of data values in the "data" file. By convention, "data" file names end with the extension ".DAT" whereas image file names end with ".IMG". Note that the disk space required by a "data" file is proportional to the blotch area and may be much more than that required by an image file which is always 513 blocks. For a full image (BPLANE=0, the equivalent of a full-image blotch), a "data" file will require 2049 blocks or about four times the space of an image file; for a blotch covering less than a quarter of the image, however, the "data" file will be smaller than an image file.

(10) BPLANE defines the number of the graphics plane containing the blotch area(s) of interest and is in the range -7 to 7. If the number entered is positive, pixels within the blotch will be considered. If the number is negative, pixels outside the blotch will be considered. Only blotches defined on this plane (the absolute value of BPLANE) of the blotch file BLO_FILE will be used. If "0" is entered, the entire image area (512 x 512) will be used and BLO_FILE will be ignored.

(11) BLO_FILE is the name of the blotch file which defines the image area(s) of interest unless BPLANE = 0. Only blotches defined on the plane corresponding to BPLANE will be used. Blotches may be drawn and saved as files using the procs BLOTCH and BPSAV. The extension ".BLO" will be used by default if it is omitted from the file name.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** MV
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc enables the user to generate a mean image and a standard deviation image from up to 36 input image files. The mean image is generated by simply taking the average of all the input images on a pixel by pixel basis. Pixels with gray levels outside the specified range are considered invalid and thus excluded from the averaging. In a similar manner, the standard deviation image is generated by calculating the standard deviations at a pixel for all the images. Again, only the valid pixels are utilized, i.e. pixels with gray levels inside the specified valid range. Note also that an output gray level of 0 is assigned to a pixel in the standard deviation image whenever it is a valid pixel and has a count less than 2. Two additional images are also generated, one representing the total number of valid pixels in the standard deviation calculation, and the other representing the ratio of the standard deviation to the mean.

**PARAMETERS:**

(1) INFILS are the input disk image file names. Up to 36, 513x512 images may be specified. All the mean and standard deviation calculations are based on these input files. The extension ".IMG" will be used by default if it is omitted.

(2) MEAN is the output mean image file name. As noted above, the mean image is generated by simply taking the average of all the valid pixels at a particular pixel locaton for all the input images. The extension ".IMG" will be used by default if it is omitted.

(3) STD is the output standard deviation image file name. This image is generated by simply taking the standard deviation of all the valid pixels at a particular pixel location for all the input images. Where the resulting count is less than 2, it is assigned a value of 0. The extension ".IMG" will be used by default if it is omitted.

(4) RATIO is the output file name for the ratio (STD/MEAN) image. The extension ".IMG" will be used by default if it is omitted.

(5) VALID is the output image file name for the number of valid pixels processed. Each pixel in this output file represents the total number of valid data pixels used in the calculation of the mean at the corresponding pixel location. The extension ".IMG" will be used by default if it is omitted.

(6) MODE is a flag which indicates whether the input data is linear (MODE=1) or pigment (MODE=2). The method used in the averaging will be adjusted accordingly.

(7) RANGE specifies the data range for analysis, i.e. all pixels with data values within the specified range are processed. Two values, in any order, are required. The values are interpreted according to the MODE parameter, i.e. if the MODE

parameter is pigment, the values entered should be in pigment units otherwise gray level values should be entered.

(8) INVALID: Pixel locations for which none of the input values satisfied the RANGE criterion will be assigned the value of INVALID. This value should be in data units corresponding to the data type specified by MODE.

**IIS BUTTON DEFINITIONS:**

No buttons are used in the execution of this program.

**PROGRAM NAME:** <u>NEWS</u>
**DATE:** <u>4/15/91</u>
**MENU:** <u>GENUTIL</u>

**DESCRIPTION:** This proc allows the user to obtain news information and bug/problem updates for a specified SEAPAK proc. Output can be sent to the terminal, a file or the system printer. The output file name will be of the form (proc).news where "proc" is the SEAPAK proc name.

**PARAMETERS:**

(1) PROC is the SEAPAK proc name on which one wants to obtain the latest news.

(2) OUTPUT designates where to send the news. Three options are available:

T = terminal,
F = file ,
P = system printer.

The output file will have the form (proc).news.

**IIS BUTTON DEFINITIONS:**
No buttons are required for this proc.

**PROGRAM NAME:** NOAAEXT
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program is used to extract individual months of MCSST (NOAA) sea surface data from a tape received from the NASA Climate Data System, which has one file of data per year. Output files contain global data every 2.5 degrees in latitude and longitude, read in order from 90 S northward to 90 N and from 180 W eastward to 177.5 E. Before running this program, the user must first use MTU to copy each tape file to disk (use fixed length sequential records of 10,512 bytes within the "CTD" option of MTU).

**PARAMETERS:**
(1) FILES is the input file specification (up to 20) of the files copied to disk using MTU.
(2) OUTDIR is the directory for the output files being created. Be sure you have enough quota! Output files are 81 blocks long for each month and data type (i.e. std. dev's, means), so each year of data would require 1,944 blocks.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** NODSST
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** NODSST will generate an image file in SEAPAK format from a multi-channel sea-surface temperature (MCSST) file distributed by the NASA Ocean Data System (NODS) at the Jet Propulsion Laboratory (JPL). The NODS input file (INFILE) is a weekly composite of sea-surface temperature (SST) data for the globe derived from the TIROS-N/NOAA satellite series' Advanced Very High Resolution Radiometer (AVHRR). INFILE represents an equirectangular image of the world (90 N to 90 S and 180 W to 180 E) having a width of 2048 and a height of 1024 grid points, each being about 20x20 km at the equator.

Each grid point contains the average of daytime MCSST values from NOAA National Environmental Satellite, Data, and Information Service (NESDIS) Global Retrieval Tapes for that area and that week. Ocean points with no satellite data have values that are interpolated using an interactive Laplacian relaxation technique. This file format and the methodology for generating it was developed at the Univ. of Miami's Rosenstiel School of Marine and Atmospheric Sciences.

**PARAMETERS:**

(1) INFILE is the name of the NODS SST disk file to be converted. (See the main help text for more information about such files.) The extension ".IMG" will be used by default if it is omitted from the file name.

(2) OUTFILE is the name of the disk file to create for the SEAPAK image generated from INFILE. The image created is equivalent to an unmapped SEAPAK grid image. Such an image does not require a control point file and may be mapped using the proc MAPIMG. INFILE is an equirectangular image of the world (90 N to 90 S and 180 W to 180 E) having a width of 2048 pixels and a height of 1024 lines. The OUTFILE image will also be equirectangular and its areal coverage will be determined by the CENTER and REDFAC input parameters. The extension ".IMG" will be used by default if it is omitted from the file name.

(3) CENTER is the latitude and longitude (in degrees and in that order) of the center point for the region you would like to extract. This point will be located at the center of the OUTFILE image generated. The areal coverage (boundaries) of this image will be determined by REDFAC.

INFILE is an equirectangular image of the world (90 N to 90 S and 180 W to 180 E) having a width of 2048 pixels and a height of 1024 lines. Therefore, to obtain an image of the world, enter CENTER=(0,0) and REDFAC=(4,4); the image will be 512 pixels by 256 lines. If CENTER=(0,0) and REDFAC=(4,2), the image generated would be 512 by 512, but the north-south direction will be stretched (greater resolution) relative the east-west direction in INFILE. As another example, to obtain

an image at the full INFILE resolution centered on Bermuda, enter CENTER=(32,-66) and REDFAC=(1,1).

(4) REDFAC are the reduction factors for the pixel and line directions, in that order, of OUTFILE relative to the image represented by INFILE. Positive values indicate subsampling (reduction) whereas negative values indicates zooming-in (expansion) by pixel replication. Note that reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Values of -1, 0, or 1 all generate an OUTFILE image having a one-to-one correspondence of pixels with INFILE grid points. See the parameter CENTER for examples on the use of REDFAC.

(5) PC_ACT: INFILE grid points contain actual AVHRR derived SST data as well as interpolated SST values (see main help text). If the percent of actual data to actual and interpolated data is greater than PC_ACT for the area covered by OUTFILE, both types of INFILE data will be used to generate OUTFILE; if the percentage is less than PC_ACT, only actual values will be used and OUTFILE pixels corresponding to INFILE grid points with interpolated values will be set to black (0 gray level). (Land pixels are always set to black.) Thus setting PC_ACT=0 results in actual and interpolated values being used in all cases, whereas setting PC_ACT=100 results in actual values only being used in all cases.

The reliability of interpolated values depends upon the availability of close grid points that contain actual data. PC_ACT allows you to eliminate interpolated values when their proportion becomes too large.

**IIS BUTTON DEFINITION:**
No buttons functions are used.

**PROGRAM NAME:** OZONE
**DATE:** 4/15/91
**MENU:** ATMOS

**DESCRIPTION:** This proc allows retrieval of data from 11 years of Total Ozone Mapping Spectrometer (TOMS) data stored in the Common Data Format (CDF), 1978 through 1986 inclusive. The user can specify up to 50 latitude/longitude points and time periods, and the corresponding ozone values for the nearest TOMS point (in Dobson units) will be retrieved and the optical thickness computed for the CZCS bands of wavelength 443, 520, 550 and 670 nm. The optical thickness is computed from:

Optical thickness at wavelength = alpha at wavelength * ozone in Dobson units

where alpha values are identical with those of the University of Miami's DSP image processing system and are as follows:

443 nm: 3.4e-6
520 nm: 4.6e-5
550 nm: 8.9e-5
670 nm: 4.0e-5

The nearest TOMS lat/lon point, along with the requested date, ozone value in Dobson units, and optical thickness at each of the wavelengths will be output to any combination of the three output devices: CRT, system printer or disk file. The TOMS data is stored as bins centered at latitudes 1 degree apart, and longitudes either 5 degrees (between 70 and 90 degrees latitude in either hemisphere), 2.5 degrees (between 50 and 70 degrees latitude in either hemisphere), or 1.5 degrees (between 50 south and 50 north) apart. Data goes from -89.5 to 89.5 latitudes and -180. to 175. longitudes.

**PARAMETERS:**
(1) LATS are the input latitudes in the range -90 to 90. Up to 50 values may be entered.
(2) LONS are the input longitudes in the range -180 to 180. Up to 50 values may be entered.
(3) DATES are the input dates in a year/Julian day format (i.e. 1978105 represents Julian day 105 of the year 1978). Up to 50 values may be entered corresponding to LATS and LONS entered above.
(4) DEST are the destinations for the output Dobson and optical thickness values. Up to 3 values for DEST may be entered, chosen from the following list: 'T' for terminal, 'F' for file (with the filename specified in parameter FILE), 'P' for system printer.

(5) FILE is the fully qualified VMS filename for the output. A value for FILE needs to be entered only if one of the values for DEST is 'F'.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this proc.

**PROGRAM NAME:** PAINT
**DATE:** 4/15/91
**MENU:** COLOR

**DESCRIPTION:** The proc PAINT pseudocolors the image in the specified refresh memory. This means that the Look-Up Tables (LUT's) associated with the red, green and blue guns of the specified channel are modified in such a way as to give various colors for different input values. The number of colors, the input count range for each color block and the color of each block are selectable by the user. A histogram is also generated which shows the frequency of occurrence for each gray level value. This can sometimes be of help in selecting the breakpoints for the color blocks.

**PARAMETERS:**

(1) CHANNEL identifies the number of the refresh memory to pseudocolor. Any integer between 1 and 14 is acceptable.

(2) SCRATCH defines the number of the refresh memory which will contain the color bar. The default is 0 which means to use the next memory after CHANNEL. Note that whatever is in this memory will be erased. The acceptable values are any integer in [0,14] except the memory designated by CHANNEL.

(3) RETAIN is a flag indicating whether or not to retain the color after exiting the program. The input should be "YES" or "NO" with "YES" being the default.

(4) RANGE specifies the minimum and maximum gray level values of the range to be pseudocolored. The difference between the maximum and minimum values of the range must be greater than or equal to the number of color blocks. The range can easily be modified within the program by using the IIS button C2. The acceptable values for the range are numbers between 0 and 255 inclusive. The minimum should be specified before the maximum. For example,

RANGE = (96,116) -- sets the minimum value of the range at 96 and maximum at 116

(5) BLOCKS is the number of color blocks (different colors) in the color bar. This number must be a value in the range [1,32]. This parameter can be modified within the program by using button A2 of the IIS button keyboard.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | | F |
|---|---|---|---|---|---|---|
| 3 | Help | Change Block (R-G-B) | Change Block (Intensity and Saturation) | Rotate Colors | | Exit |
| 2 | Modify Number of Color Blocks | Define Breakpoints | Define Range | Do Current Color | | Save Colors |
| 1 | Image (On/Off) | Histogram (On/Off) | Cursor/ Color Bar (On/Off) | Image Color (On/Off) | | Reload Colors |

A3: This button provides help descriptions of any of the other buttons. It asks which BUTTON one needs to obtain information on. Examples of acceptable input would be:

BUTTON = A2
BUTTON = C3

B3: This button allows one to modify the color of any color block. Modification is done by first moving the cursor over the desired block and then depressing this button. At this point, the user is prompted for input to the parameter COLOR. One now enters three integer values in the range of 0 to 255 for this parameter. The first value entered corresponds to the red component to be assigned to the color block currently being identified by the cursor. The second value entered corresponds to the green component and the third value entered corresponds to the blue component. If the cursor is not on any of the color blocks, no color change will be observed. The existing red, green and blue intensities of the selected color block are supplied as the defaults. When the intensities are assigned, the color and the look-up tables are modified accordingly.

C3: This button allows one to interactively change the intensity and saturation of any color block. Modification is done by first moving the cursor over the desired block and then depressing this button. The cursor is then automatically moved to the center of the screen and blinks. The cursor now can be used to change the intensity and saturation. Any horizontal movement of the cursor modifies saturation (movement to the right increases saturation, to the left decreases), while any vertical movement modifies intensity (movement down increases

intensity, up decreases). In short, this means that horizontal movement to the left brings all values closer to their average; while movement to the right moves values away from their average. Two examples are:

Horizontal left: (10,100,200)-->(94,103,112)
Horizontal right: (10,100,200)-->(0,92,252)

For vertical motion down, all values go up proportionately; for vertical motion up, all values go down. Two examples are:

Vertical down: (100,100,100)-->(174,174,174)
Vertical up: (100,100,100)-->(34,34,34)

The portion of the look-up tables corresponding to this color block is simultaneously modified with the color block itself. To exit from this interactive mode, simply depress any button.

D3: When this button is depressed, the colors of all defined blocks are rotated in a circular, shift right manner. The look-up tables are then modified accordingly.

F3: This button is depressed to exit the PAINT pseudo-coloring utility.

A2: This button enables one to modify the number of color blocks. After depressing this button, one is prompted with the parameter BLOCKS. This parameter designates the total number of color blocks to be displayed at the bottom of the image currently undergoing the PAINT process. An integer value in the range of 1 to 32 should be entered. The current number of color blocks is supplied as the default. The look-up tables are modified to correspond to modification in the number of color blocks.

B2: One can enter breakpoints for the color blocks using this button. After depressing this button, the user is prompted with the parameter BREAKS. The user should enter the values desired for the gray level breaks. The endpoints are assumed to be 0 and 255 and are not to be entered (Button C2 can redefine this range if need be) unless blocks having single values ranges of 0 or 255 are desired. Up to 30 points may be entered. The number of breakpoints plus 1 equals the number of color boxes created.

C2: This button enables the user to change the range over which the pseudocolor will be applied. One simply depresses this button and enters via the keyboard the starting and ending gray-levels requested by the parameter RANGE. The starting gray-level must always be lower than the ending value of the range. The range usually starts at 0 and ends at 255 to cover all the gray level values. The range can, however, be narrowed to eliminate color painting of certain data. The range excluded will retain the original gray shade color instead of pseudo color as designated by the color blocks. The specified range will be evenly divided into the total

number of color blocks, thus a change of range will cause each color block to change its gray level interval.

D2: This button allows the user to pseudocolor only the image values corresponding to a selected color block. To examine a single color, one must first depress button D1 to get all look-up tables back to a linear (gray) state. Then, by moving the cursor over the desired color block and depressing button D2, one can examine all gray levels defined by the selected block in the color assigned to that block.

F2: One may save the present look-up tables (colors) on disk by depressing this button and entering a host filename.

A1: The image itself may be toggled on and off by simply depressing this button. The purpose for this is to make examination of the histogram easier.

B1: The histogram may be toggled on and off by depressing this button.

C1: One may toggle the cursor and color bar on and off by depressing this button.

D1: One may toggle between black/white and color in the image by depressing this button.

F1: Colors saved on disk may be reloaded by depressing this button and then entering the host file name.

**PROGRAM NAME:** PIXLINE
**DATE:** 4/15/91
**MENU:** COLOR

**DESCRIPTION:** Program PIXLINE examines the pixel values at the current cursor position in the red, green, and blue components of an image as well as their corresponding LUT values. If this image consists of a single band, the pixel values will be the same for each color component. If the image is also not pseudocolored, the LUT values will also be the same for each color. This information is formatted to a status line that is overlayed on the top of the display in a bit plane.

**PARAMETERS:**

(1) CHANNEL is used to select the list of channels to be displayed and then examined. This can include a single gray scale image or up to 3 separate channels which are to be analyzed on a red/green/blue component basis. The display method is different depending on whether 1, 2, or 3 channels are selected. The results of the different selections are:

a) Single channel: Display selected single channel through the Red, Green and Blue pipelines, producing a Black and White image or one which is pseudocolored if the LUT's had been previously set.

b) Two channels: Display the first channel through the Red pipeline and the second through the green and blue pipelines.

c) Three channels: Display the first channel through the Red pipeline, the second through the green pipeline, and the third through the blue pipeline.

(2) GBITPL selects the graphics bit plane where the pixel value information is to be written. This information occupies a full band consisting of the uppermost 15 lines of the display. A new annotation line is drawn each time the A3 button on the IIS keypad is pressed. A typical information line looks like this:

X=023 Y=129 RED=103/202 GREEN=032/191 BLUE=167/167

Where,

a) X=023 defines the X coordinate cursor position,

b) Y=129 defines the Y coordinate cursor position,

c) RED=103/202 defines pixel value and LUT value, i.e. 103 is the actual pixel value of the red component channel and 202 is the LUT translation of the red pixel value,

d) GREEN=032/191 is defined similar to RED above,

e) BLUE=167/167 is defined similar to RED above also.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Examine Image | Toggle Red Band | Toggle Green Band | Toggle Blue Band | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: Depressing this button allows one to determine the X and Y coordinates of the present cursor location as well as the pixel and LUT values for the channels selected.
B3: A toggle which turns the RED band on or off.
C3: A toggle which turns the GREEN band on or off.
D3: A toggle which turns the BLUE band on or off.
F3: This button causes the program to terminate and return to SEAPAK.

**PROGRAM NAME:** PLI
**DATE:** 4/15/91
**MENU:** LUT

**DESCRIPTION:** This program provides the capability to modify the Look-Up Tables (LUT's) of the IIS display in a piecewise linear manner. The breakpoints are initially set via parameter input. Following execution of the program, the trackball is used to interactively control the stretching. With the use of the trackball and the IIS buttons, one can adjust the breakpoints, create or delete breakpoints, and/or adjust the slope between them. Up to two blotch planes can be specified and subsequently used to define specific regions for stretching (these regions can be either inside or outside the defined blotches). It is also possible to limit the area of enhancement to portions of the defined blotch planes by logically combining them with an "AND", "OR" or "XOR" (or to select the area exterior to this resulting region). The stretching of individual red, green or blue LUT's is also supported.

**PARAMETERS:**

(1) BLOTCH specifies the graphics planes in which the blotches (if any) are defined. Up to two graphics planes can be specified to define the region of interest. A positive value indicates a region inside the blotched plane, whereas a negative value indicates a region outside the blotched plane. If no blotch planes are being used, enter a zero.

(2) OPTION is the parameter which defines how to combine the blotch regions to form a new area of interest. This parameter is, of course, only used when two blotching planes are specified. The acceptable input values are "AND", "OR" or "XOR". The "XOR" is an "exclusive or" which means those areas which are contained in the two blotches except for the overlapped area.

(3) INBRK are the break points used in forming the piecewise linear map. Up to 10 integer values can be entered for this parameter. The values entered should fall in the range of 0 to 255. At least two values must be entered.

(4) OUTBRK are those values which are used as the "to" break points for the piecewise linear intensity mapping. These correspond to the "from" breakpoints (INBRK) and should thus have the same number of points. The values entered should fall in the range of 0 to 255.

(5) PLANES defines which planes can be used as scratch for the graphics. One should enter five integer values in the range of 1 to 7 for this parameter. The values entered must be different from the blotching planes if the blotch option is to be used. The values entered designate the graphics planes for the plotting functions as follows :

1st plane : initial histogram display

2nd plane : PLI mapping
3rd plane : current histogram display (after stretching)
4th plane : window for the overall graphics
5th plane : active break point indication circle.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Modify All Colors | Modify Red Only | Modify Green Only | Modify Blue Only | Exit |
| 2 | Move To Left Break Point | Move To Right Break Point | Lock Cursor In X | Lock Cursor In Y | Histogram On/Off |
| 1 | Insert Break Point On Left | Insert Break Point On Right | Delete Active Break Point | Graphics On/Off | Image On/Off |

A3: This button causes all the colors to be modified in the same way, i.e. will keep it as a gray scale since each gun has the same LUT. This is the default mode when the program is entered.
B3: Allows one to modify only the red LUT.
C3: Allows one to modify only the green LUT.
D3: Allows one to modify only the blue LUT.
F3: Depressing this button exits the program.
A2: This permits one to move over to the next breakpoint on the left. One can then start moving it around as one sees fit to obtain the contrast one wants.
B2: This permits one to move on to the next breakpoint to the right. One can then adjust the contrast of the associated range of gray levels.
C2: This button acts as a toggle and causes the active breakpoint to be locked/released from a fixed X coordinate.
D2: The same as C2 except with the Y coordinate.
F2: The histogram is toggled on or off with this button.
A1: Depressing this button allows one to insert a breakpoint to the left of the active one. This breakpoint will be inserted halfway between the active one and the one to the left.
B1: Depressing this button allows one to insert a breakpoint to the right of the active one. This breakpoint will be inserted halfway between the active one and the one to the right.
C1: This button enables one to delete the currently active breakpoint.

D1: This toggles the mapping graphics on or off.
F1: This toggles the image on or off.

**PROGRAM NAME:** PLOTLOC
**DATE:** 4/15/91
**MENU:** ENVIROLIST, UNGRIDANL

**DESCRIPTION:** This proc will plot the locations (latitudes/longitudes) listed in a disk file on a specified graphics plane over a displayed image. The list file format may be specified using the input parameters. The character used for plotting may be specified and a line connecting these locations may be requested. The IIS Model 75 image display must first be allocated (proc ALLOC).

**PARAMETERS:**

(1) LISTFILE is the name of the disk file containing the latitudes and longitudes to mark on the displayed image. Each of these geocoordinate pairs must be contained on individual, consecutive records. The parameters SKIP_LIN, COLUMN, WIDTH, and DECIMAL may be used to specify the format of the latitude and longitude values. The extension ".LST" will be used by default if it is omitted from the file name.

(2) SKIP_LIN is the number of non-data lines at the top of the input data file LISTFILE. These lines may include column headings or other information and will be skipped before starting to read the input data. (See DATA_LIN.)

(3) DATA_LIN is the number of data lines (records) to read from the file LISTFILE. The parameters COLUMN, WIDTH, and DECIMAL may be used to specify the format of data lines. The first data line to be read will be the SKIP_LIN+1 line of the file; the last will be SKIP_LIN+DATA_LIN unless the end-of-file (EOF) is encountered. If DATA_LIN=0 (default), the program will read until the EOF.

(4) SUBSAMPL is the subsampling rate for plotting the input points. For example, if SUBSAMPL=1, the program will attempt to plot each input point, if SUBSAMPL=2, the program will attempt to plot every other input point, etc. The first point used for plotted will be SKIP_LIN+1 regardless of SUBSAMPL.

(5) COLUMN is the starting columns of the fields in the LISTFILE records containing the latitude degrees, latitude minutes, longitude degrees, and longitude minutes, respectively. The columns are the character locations starting from the left where the leftmost character is in column one.

For latitudes, if COLUMN(2)=0, the first field is assumed to contain decimal degrees of latitude for which DECIMAL(1) may be used to specify the number of decimal places. Otherwise, the second field is read for latitude minutes and the two latitude fields are used to determine the decimal degree latitudes. Similarly, if COLUMN(4)=0, decimal degree longitudes are assumed for the third field and DECIMAL(2) may be used to specify its decimal places; otherwise, the fourth field is read as longitude minutes.

Note that the latitude and longitude degree fields are read in as real-numbered values. If any of their values explicitly contain a decimal point, it will be used as such and will override any DECIMAL specification.

(6) WIDTH is the character widths of the fields (i.e., the LISTFILE columns) containing the latitude degrees, latitude minutes, longitude degrees, and longitude minutes, respectively. WIDTH(n) represents the maximum number of characters in field n starting at COLUMN(n). If the COLUMN value for a latitude or longitude minute field is zero, the corresponding WIDTH value is ignored.

Note that the latitude and longitude degree fields are read in as real-numbered values. If any of their values explicitly contain a decimal point, it will be used as such and will override any DECIMAL specification.

(7) DECIMAL may be used to specify the number of decimal places to assign the latitude and longitude degree fields. However, if any decimal is explicitly contained in a value read, it will override the DECIMAL specification. Therefore, if all values of a field contain a decimal point, you need not use its corresponding DECIMAL value.

DECIMAL(1) is ignored if COLUMN(2) is not zero indicating that latitude degrees and minutes are to be read in. In such a case, the degree values should be integers. Similarly for longitudes, DECIMAL(2) is ignored if COLUMN(7) is not zero.

Examples: For DECIMAL(n) = 2,

| Value in Field | Value Used |
|---|---|
| 123 | 1.23 |
| 1 | 0.01 |
| -1234 | -12.34 |
| 123.4 | 123.40 |
| 0 | 0.00 |
| (blank) | 0.00 |

(8) WINDOW defines a rectangular view area which may be all or part of the entire image display area. Only geocoordinate points (lat/lon values) falling within this view area will be plotted. To define the view area, enter the start pixel, end pixel, start line, and end line numbers in that order. The maximum display area is 512 pixels wide by 512 lines high and is used by default.

(9) BORDER: If "YES", straight lines will be drawn around the view area defined by WINDOW. "NO" is the default value.

(10) PLANE is the number (1-7) of the graphics plane to be used. for marking the locations and, if CONNECT="YES", their connecting lines. This plane will also be used for the border if requested and for the label if specified. Note that graphics already on this or other planes will not be affected.

(11) CHARACTR is a character to use for plotting the latitude/ longitude locations. (Non-displayable characters (such as a

tab) will appear as "?".) If a blank is used and CONNECT= "YES", only the connecting line segments will be drawn. (If a blank is used and CONNECT="NO", an error will result.)

(12) CONNECT: Enter "YES" to connect the plotted points by a line. Note that two adjacent positions will not be connected if one of the two locations is off the image area.

(13) LABEL is a label to annotate the first point plotted. This parameter may thus be used to label a set of points defining a cruise or other type of track. When the points are to be connected (CONNECT="YES"), LABEL will also be applied to the first point of each disconnected segment. Such segments will result when one or more (non-end) points fall outside the WINDOW boundary. (See LAB_OFF.) If blank (default), LABEL will be ignored.

(14) LAB_OFF is the pixel and line offsets, respectively, for use when writing LABEL. The offsets refer to the distance between the plotted point and the center of the label string. If LABEL is blank, LAB_OFF will be ignored.

(15) DISP_MSG is a flag for controlling the extent of informational messages displayed on the terminal by the program regarding the locations it tries to plot:

| | | |
|---|---|---|
| 0 | => | Displays no messages. |
| 1 | => | Displays lat/lon when location is outside window. (If outside window but within image bounds, pixel/line are also displayed.) |
| 2 | => | Same as 1 plus lat/lon and pixel/line when location is inside window. |

**IIS BUTTON DEFINITIONS:**

No buttons are used.

**PROGRAM NAME:** PROG1
**DATE:** 4/15/91
**MENU:** CZCSPROG

**DESCRIPTION:** This program runs a demonstration on the IIS model 75 of a core group of SEAPAK programs. The user can interactively run each program with sample images which are provided, and then exit each application to move on to the next. The following SEAPAK programs will be run, in order: ANGST, GYRE, FILLM, HIST, READ, RLINE, PLI, VARIOG, CORCO, XCORR, TERIES, (pigment images of South Atlantic winter and summer seasons, winter-summer difference, standard deviation, and ratio of standard deviation to mean), TRACK, and MEM. The user should refer to the write-ups on each of these programs for more information on their operation.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Check the individual programs called by this program for descriptions of their button menus.

**PROGRAM NAME:** PSTIMG
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** PSTIMG will generate an image file in SEAPAK format from a "binned" ("postage-stamp" or PST) file of the University of Miami's DSP image analysis system. The image represented by the PST file is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines. Each of these pixels is referred to as a "bin" representing approximately 20x20 kilometers at the equator. Each bin contains data from the corresponding pixels of the larger resolution image(s) used to generate the PST file.

**PARAMETERS:**

(1) DSP_IMG is the name of the PST disk file to be converted. The name must be in DSP syntax and include the subimage name and the desired band name: "filename/subimage/band". In this case, the subimage specification is always "/PST". The band name is only used if OUT_TYPE is 1 or 2. Possible band names include "K490", "Chlor", "La670", "nLw550", "nLw520", and "nLw440". No default portions are provided. The band name prefixes "sum_" and "sum_squared_" are optional. If the directory (path) is not specified, the current directory is assumed.

Examples:
1) "PSTNAME.PST/PST/CHLOR",
a PST file in the current directory.
2) "SIA5:[account.subdir]PSTNAME.PST/PST/CHLOR",
a PST file in a specified subdirectory.

The image represented by DSP_IMG is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines.

(2) OUTFILE is the name of the disk file to be created for the SEAPAK image generated from DSP_IMG. The image created is equivalent to an unmapped SEAPAK grid image. Such an image does not require a control point file and may be mapped using the proc MAPIMG. The image represented by DSP_IMG is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines. The OUTFILE image will be based on that projection and its areal coverage will be determined by the CENTER and REDFAC input parameters. If a device is not specified in the name, "SCRATCH:" will be used; if the device and the directory are not specified, the user's root (main) directory will be used. The extension ".IMG" will be used by default if it is omitted from the file name. The name must be a valid host file name.

Example: "OUTNAME" ==> "SCRATCH:[acctname]OUTNAME.IMG"

(3) OUT_SIZE specifies the width and length of OUTFILE. The default values are for a standard SEAPAK image of 512x512. The width may range from 1 to 2048 and the length may range from 1 to 1024. OUTFILE will be a fixed-length file with record lengths of OUT_SIZE(1) bytes. Each byte represents a gray value for the output image. The number of records will be OUT_SIZE(2) plus a header record if HEADER="YES." Note that, if OUT_SIZE(1)<512, any header record will be truncated to that size. To generate a standard SEAPAK image file, HEADER must be "YES" and OUT_SIZE must be (512,512). Otherwise, OUTFILE will not be a valid SEAPAK image for use with other procs.

(4) HEADER requires a "YES" or "NO" to indicate whether or not a SEAPAK image header is to be written at the beginning of OUTFILE. Note that, if OUT_SIZE(1)<512, the header record will be truncated to that size.

(5) CENTER is the latitude and longitude (in degrees and in that order) of the center point for the region you would like to extract. This point will be located at the center of the OUTFILE image generated. The areal coverage (boundaries) of this image will be determined by REDFAC. The image represented by DSP_IMG is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines. Therefore, to obtain an image of the world, enter CENTER=(0,0) and REDFAC=(4,4); the image will be 512 pixels by 256 lines. If CENTER=(0,0) and REDFAC = (4,2), the image generated would be 512 by 512, but the north-south direction will be stretched (greater resolution) relative to the east-west direction in DSP_IMG. As another example, to obtain an image at the full DSP_IMG resolution centered on Bermuda, enter CENTER=(32,-66) and REDFAC=(1,1).

(6) REDFAC is the reduction factors for the pixel and line directions, in that order, of OUTFILE relative to the image represented by DSP_IMG. Positive values indicate subsampling (reduction) whereas negative values indicates zooming-in (expansion) by pixel replication. Note that reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Values of -1, 0, or 1 all generate an OUTFILE image having a one-to-one correspondence of pixels with DSP_IMG pixels (bins). The image represented by DSP_IMG is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines. Therefore, to obtain an image of the world, enter CENTER=(0,0) and REDFAC=(4,4); the image will be 512 pixels by 256 lines. If CENTER=(0,0) and REDFAC=(4,2), the image generated would be 512 by 512, but the north-south direction will be stretched (greater resolution) relative to the east/west direction in DSP_IMG. As another example, to obtain an image at the full

DSP_IMG resolution centered on Bermuda, enter CENTER=(32,-66) and REDFAC=(1,1).

(7) OUT_TYPE is the index number for the type of to be contained in the OUTFILE image: 1, mean (default); 2, standard deviation; 3, pixels per bin; or 4, image count. The image represented by DSP_IMG is assumed to be an equirectangular image of the world (90N to 90S and 180W to 180E) having a width of 2048 pixels and a height of 1024 lines. Each of these pixels is referred to as a "bin" representing approximately 20x20 kilometers at the equator. Each bin contains data from the corresponding pixels of the larger resolution image(s) used to generate the PST file. A pixels-per-bin image (index 3) will represent in gray levels the number of valid scene pixels used to obtain the data sums for each bin. A mean image (index 1) will be that of the band-name value divided by the pixels-per-bin for each bin. (The band name is specified in the DSP_IMG entry.) Index 2 will generate an image of the standard deviation for each pixel in the corresponding mean image. An image count image (index 4) will generate an image whose gray values are proportional to the number of satellite scenes which contributed to the summation of the data for the corresponding bins in the DSP_IMG file.

(8) MIN_DATA may be used to define the intercept of the equation used to linearly scale the PST file's data values to gray levels. Because MIN_DATA is used only for linearly-scaled data, it will be ignored for pigment input data when OUT_-TYPE is 1 (mean) or 2 (standard deviation). When used, input data values less than MIN_DATA will be set equal to MIN_DATA. The scaling is done as follows:

```
     SLOPE = (MAX_DATA - MIN_DATA) / 255.0
GRAY_LEVEL = nearest_integer[(DATA_VALUE-MIN_DATA) / SLOPE]
```

If the null value "--" (default) is entered for MIN_DATA and MAX_DATA, a set of "standard" slopes and intercepts are used according to the input band specified in DSP_IMG and the value of OUT_TYPE:

1. If input band is for nLw440, nLw520, or La670, and OUT_TYPE equals 1 or 2, SLOPE=0.01 and MIN_DATA=0.0.
2. If input band is for K490 and OUT_TYPE=1, SLOPE=0.001 and MIN_DATA=0.0.
3. If input band is for K490 and OUT_TYPE=2, SLOPE=0.01 and MIN_DATA=0.0.
4. If OUT_TYPE=3, SLOPE=5.0 and MIN_DATA=4.0.
5. If OUT_TYPE=4, SLOPE=1.0 and MIN_DATA=0.0.

If the null value is entered for MIN_DATA but not for MAX_DATA, the actual minimum of the extracted input data will be used for MIN_DATA and the entered value for MAX_-DATA. If the null value is entered for MAX_DATA but not for

MIN_DATA, the actual maximum will be used for MAX_DATA but not for MIN_DATA. If the same numeric value is entered for each, the actual minimum and maximum values will be used to determine the slope and intercept. (Otherwise, an improper slope of zero would result.)

(9) MAX_DATA may be used to determine the slope of the equation used to linearly scale the PST file's data values to gray levels. Because MAX_DATA is used only for linearly-scaled data, it will be ignored for pigment input data when OUT_-TYPE is 1 (mean) or 2 (standard deviation). When used, input data values grater than MAX_DATA will be set equal to MAX_DATA. The linear scaling used and the meaning of the null (default) value are explained in the MIN_DATA description.

(10) DEVICE is the name of a device which contains DSP_IMG and which must be mounted. The device will be mounted for reading only and will be dismounted after program execution. For example, "LDB0" or "LDB1" may be entered to mount the optical disk drives on the DIATOM node of the Laboratory for Oceans' local area VAX cluster.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** PSTMATCH
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** This proc extracts data from daily PST files for comparison with "sea-truth" or other data contained in LISTFILE. PST files corresponding to each sea-truth date plus or minus a number of days up to DELTA_T will be sought and searched. Data from the bin containing the sea-truth location and the eight surrounding bins (if SURR_BIN="YES") are extracted, if available, and output. The data to extract may be specified by PARAMS. (When run in batch, messages normally displayed on the terminal will be output to a file called PSTMATCH.OUT if PROGRESS="YES".)

A PST file represents an equirectangular image of the world (90 N to 90 S and 180 W to 180 E) having a width of 2048 pixels and a height of 1024 lines. Each of these pixels is referred to as a "bin" representing approximately 20x20 km at the equator. Each bin contains data from the corresponding pixels of the larger resolution CZSC image(s) used to generate the PST file. The bins are numbered to identify their locations since those for which no data was available are excluded from the file.

**PARAMETERS:**

(1) LISTFILE is the name of the disk file containing the "sea-truth" data for which corresponding data is to be extracted from the PST files. Each of these data values must be accompanied by an associated latitude and longitude degree pair with optional minutes for each. The day, month, and year of each data point may also be included. The information for each data point must be contained on the same record and the data records must be consecutive. See the help text for SKIP_LIN, COLUMN, WIDTH, and DECIMAL which may be used to specify the format of LISTFILE. The extension ".LST" will be used by default if it is omitted from the file name.

(2) SKIP_LIN is the number of non-data lines at the top of the input data file LISTFILE. These lines may include column headings or other information and will be skipped before starting to read the input data.

(3) COLUMN are the starting columns of the fields in the LISTFILE records which contain the day, month, year, latitude degrees, latitude minutes, longitude degrees, longitude minutes, and "sea-truth" data, respectively. The columns are the character locations starting from the left where the leftmost character is in column one. The day, month, year, latitude minutes, and longitude minutes are optional fields for which zeros may be entered as their COLUMN values.

If zero is entered for the day, month, or year starting columns, the value specified by the parameter DAY, MONTH, or YEAR, respectively, will be used instead and will apply for all sea-truth values. If COLUMN(2)=0 and MONTH are null, the day field in LISTFILE or the value specified by DAY will be

assumed to be the Julian day of the year; otherwise, the Gregorian day of the month will be assumed. For the year field, if COLUMN(3)>0, WIDTH(3) will determine how the year value is interpreted. See the help text of WIDTH for additional information.

For latitudes, if COLUMN(5)=0, the fourth field is assumed to contain decimal degrees of latitude for which DECIMAL(1) may be used to specify the number of decimal places. Otherwise, the fifth field is read for latitude minutes and the two latitude fields are used to determine the decimal degree latitudes. Similarly, if COLUMN(7)=0, decimal degree longitudes are assumed for the sixth field and DECIMAL(2) may be used to specify its decimal places; otherwise, the seventh field is read as longitude minutes. Finally, DECIMAL(3) may be used to specify the decimal places of the sea-truth values.

Note that the five latitude, longitude, and sea-truth data fields are read in as real-numbered values. If any of these values explicitly contain a decimal point, it will be used as such and will override any DECIMAL specification. (The day, month, and year values are considered integers, and any decimal point in their fields will result in an error.)

(4) WIDTH are the character widths of the fields (i.e., the LISTFILE columns) containing the day, month, year, latitude degrees, latitude minutes, longitude degrees, longitude minutes, and "sea-truth" data, respectively. WIDTH(n) represents the maximum number of characters in field n starting at COLUMN(n). If the COLUMN value for any optional field is zero, the corresponding WIDTH value is ignored. The optional fields are those of the day, month, year, latitude minutes, and longitude minutes are.

For the year field, if WIDTH(3)=1, a base of 1980 is added to the single digit read in; if WIDTH=2, a base of 1900 is added; if WIDTH=3, a base of 1000 is added; and if WIDTH>3, the value is used as is. Therefore, it is important to specify the exact width of the year field (i.e., exclude blank or other delimiters) when the field is less than four characters wide to prevent misinterpretation of the value read.

Note that the five latitude, longitude, and sea-truth data fields are read in as real-numbered values. If any of these values explicitly contain a decimal point, it will be used as such and will override any DECIMAL specification. (The day, month, and year values are considered integers, and any decimal point in their fields will result in an error.)

(5) DECIMAL may be used to specify the number of decimal places to assign the latitude degree, longitude degree, and "sea-truth" fields, respectively. However, if any decimal is explicitly contained in a value read, it will override the DECIMAL specification. Therefore, if all values of a field contain a decimal point, you need not use its corresponding DECIMAL value.

DECIMAL(1) must be zero if COLUMN(5) is not zero indicating that latitude degrees and minutes are to be read in. In such a case, the degree values should be integers. Similarly for longitudes, DECIMAL(2) must be zero if COLUMN(7) is not zero.

Examples: For DECIMAL(n) = 2,

| Value in Field | Value Used |
|---|---|
| 123 | 1.23 |
| 1 | 0.01 |
| -1234 | -12.34 |
| 123.4 | 123.40 |
| 0 | 0.00 |
| (blank) | 0.00 |

(6) DAY: If COLUMN(1)=0, implying that LISTFILE does not contain a day field, a day value common to all dates of the "sea-truth" data may be specified using DAY. If COLUMN(2)=0 and MONTH are null, the DAY value will be assumed to be the Julian day of the year; otherwise, the Gregorian day of the month will be assumed.

(7) MONTH: If COLUMN(2)=0, implying that LISTFILE does not contain a month field, a month value common to all dates of the "sea-truth" data may be specified using MONTH. If COLUMN(2)=0 and MONTH are null, the day field in LISTFILE or the value specified by DAY will be assumed to be the Julian day of the year; otherwise, the Gregorian day of the month will be assumed.

(8) YEAR: If COLUMN(3)=0, implying that LISTFILE does not contain a year field, a year value common to all dates of the "sea-truth" data may be specified using YEAR.

(9) PST_DIR is the directory path specifying the location of the daily PST files to be searched by the program. The path may or may not include the specifications for a node, a device, or a directory. If a node is not specified, the current node is assumed. If a device is not specified, "SCRATCH:" will be used; if the device and the directory are not specified, the user's root (main) directory will be used. Any portion of the filename after the directory path will be ignored.

PST files are assumed to be named as "Cyyddd.DAILYPST" where yy indicates the year and ddd indicates the Julian day (with leading zeros) of the CZCS data in the file. Daily PST files are those that contain processed CZCS data for the given day. See the main help text above for information on the format of PST files.

(10) DEVICE is the name of a device which contains the directory specified by PST_DIR and which must be mounted. The device will be mounted for reading only and will be dismounted after program execution. The default is the null value "--" and implies that the device of PST_DIR need not be mounted. For example, "LDB0" or "LDB1" may be entered to mount the optical

disk drives on the DIATOM node of the OCF's local area VAX cluster.

(11) DELTA_T represents the maximum number of days before and after the "sea-truth" dates for which PST data can be sought. That is, all daily PST files for days within the resulting date range will be searched for data in bins corresponding to the sea-truth locations. If found, these data will be output to OUT_FILE.

(12) SURR_BIN: If found, data for the bin containing a "sea-truth" location (as specified by the latitude/longitude LISTFILE fields) are extracted and output to OUT_FILE. If SURR_BIN= "YES", data for the surrounding eight bins are also extracted and output if found. In this case, bins for which data was found are output in the following order: center (C), north (N), northeast (NE), east (E), southeast (SE), south (S), southwest (SW), west (W), and northwest (NW).

(13) PARAMS: The following parameters may normally be extracted from a PST file for each bin:

| | |
|---|---|
| PXLS: | Number of pixels |
| IMGS: | Number of CZCS scenes |
| BINO: | PST bin index: 0 to 2,097,151 (1024*2048 - 1) |
| XCHL, SCHL: | Average pigment and standard deviation |
| X490, S490: | Avg absorption (490 nm) and standard deviation |
| X440, S440: | Avg radiance (440 nm) and standard deviation |
| X520, S520: | Avg radiance (520 nm) and standard deviation |
| X550, S550: | Avg radiance (550 nm) and standard deviation |
| X670, S670: | Avg radiance (670 nm) and standard deviation |

You may request up to nine of any of these parameters. The order in which they are specified is the order in which their data will appear in each OUT_FILE record.

(14) OUT_FILE is the name of the disk file to create for the output of the data extracted from the PST files. Each record output will include the latitude, longitude, year, Julian day, the day offset (up to +- DELTA_T), the "sea-truth" value, the bin designation (if SURR_BIN="YES"), and the PARAMS values requested from the PST files. Thus, for each sea-truth value, up to 99 records may be output. (If SURR_BIN="YES" and DELTA_T=5, we may get records for nine bins for each of -5 to +5, or 11, days.) A record will not be output if the PST file corresponding to the year/day/offset date is not found or if the desired bin was found to contain no data. The extension ".LST" will be used by default if it is omitted from the file name.

(15) DELIM is a one-character delimiter which will be used to separate the output fields in OUT_FILE. Certain spreadsheet or statistical programs, which you may wish to use on the output file, require such delimiters. Some characters, such as a blank or tab, must be enclosed in double quotes when entering them as values to DELIM; to use a double quote itself as a delimiter, enter four consecutive double quotes ("""").

(16) PROGRESS: Enter YES if you would like the program to display a message whenever a new PST file is found and searched for the desired data. The corresponding LISTFILE data record number will also be displayed with the PST file name, providing a convenient way to monitor the progress of the processing.

If PSTMATCH is being run in batch and PROGRESS="YES", a file called PSTMATCH.OUT will be created that contains messages (such as the file names found) that would normally be displayed on the terminal if it were being run interactively. This file will also contain any errors messages that may have been issued. If PROGRESS="NO", PSTMATCH.OUT will not be created.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** RDDRIFTER
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDDRIFTER is used to list drifter data (FGGE, FOCAL (Reverdin) or NODC file designator F156) from an index file and a relative data file created with IXNODCDR, IXFGGEDR, IXPATDR or IXREVDR. Data parameters may be selected as follows: record number, date, time, surface temperature, salinity, bottom depth, air temperature, sea level pressure, wind direction, wind speed, quality control indicator for surface temperature, quality control indicator for pressure, quality control indicator for location, eastward/northward velocity, or eastward/northward acceleration. The program can be run interactively or in a batch mode (by specifying delimiter ¦runtype=batch¦ immediately following the "run" command in the tutor screen). When running in a batch mode, all drifters matching the space/time criteria are selected and their data written to the output file. For both modes, the data records can be queried and sorted by location and time. Up to 50 time ranges can be entered during a single run. These will be run in order during program execution. For interactive mode, the qualifying records are listed to the terminal. The listing automatically stops once the terminal screen is filled (20 records). At this point, the user may select a drifter or list another page of drifters. Once a drifter is selected, the first page of its data is displayed. The user may continue the listing, stop the listing (thus printing the contents to OUTFILE) or restart the listing at a different point. If stop is selected, the user is given the choice to return to the first menu, return to the drifter listing or to proceed to the next time period (if any). Once the last page of drifters is listed, the continue option returns the user to the first menu.

One of the items listed in the header for each drifter is the configuration code. This appears only in the processed FGGE IIb (Patterson) dataset. Its meaning is as follows:

0 = "not drogued"
1 = "drogued"
2 = "equipped with sail"
3 = "deployed on an iceberg"
4 = "initially moored"
5 = "air-dropped on Arctic ice"
6 = "deployed in Bouvet Island"
7 = "configuration unspecified"

PARAMETERS:
(1) INFILE is the index filename. An example would be SF:NC_SEQ_-FOC_DR.DAT, which is the NODC SEQUAL/FOCAL data set which has been ingested using IXXBT. Note that the SF: is a logical name pointing to the SEQUAL/FOCAL data location. The filename

(NC_SEQ_FOC_DR.DAT) is a dummy name; it doesn't exist on disk. The files actually used are NC_SEQ_FOC_DR1.DAT (an index file) and NC_SEQ_FOC_DR2.DAT (a relative file), each created by IXNODCDR.

(2) LAT is the latitude range to be surveyed (-90 to 90).

(3) LON is the longitude range to be surveyed (-180 to 180).

(4) SDATE is the array of up to 50 start dates for the time ranges to be surveyed. Input is in a YYMMDD format.

(5) EDATE is the array of up to 50 end dates for the time ranges to be surveyed. Input is in a YYMMDD format.

(6) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).

(7) LISTFILE is the filename of the ASCII station listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(8) DSPSTEP is the output display interval, i.e. an input of 2 means to display every other point along the drift.

(9) OUTFILE is the filename for the output ASCII data listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(10) MFLAG is a flag for whether each drifter parameter is to be ingested or not. Enter a 0 for a given parameter to skip it, or a 1 to ingest it. The parameters are as follows (NOTE: for certain parameters, only a subset of the drifter data archive is supported. "NODC" refers to the NODC format drifters ingested by IXNODCDR, "FGGE" refers to the FGGE level IIb format ingested by IXFGGEDR, "Patterson" refers to the processed level IIb format ingested by IXPATDR, and "Reverdin/FOCAL" refers to the format ingested by IXREVDR).

1. Record number
2. Date
3. Time
4. Surface temperature in degrees C (NODC, FGGE)
5. Salinity in parts per thousand (NODC only)
6. Bottom depth in meters (NODC only)
7. Air temperature in degrees C (NODC only)
8. Sea level pressure in millibars (FGGE, NODC, Reverdin/FOCAL type 4)
9. Wind direction in degrees (NODC, Reverdin/FOCAL type 4)
10. Wind speed in meters/sec (NODC, Reverdin/FOCAL type 4)
11. QC flag - surface temperature (FGGE only)

    0 = "No quality control performed, or quality control performed but no evidence that data suspect or bad"
    2 = "Value considered suspect"
    3 = "Value considered incorrect"
    9 = "Value missing: no data of this type reported (primarily used for stations on ice were no SST measurements obtained)"

12. QC flag - pressure (FGGE only)

    0 = "Data comes from an overpass on which location was not computed"
    1 = "Location was computed using two passes on one satellite"
    2 = "Location was computed using two passes, one for each of two satellites"
    3 = "Location was computed using one pass only"

13. QC flag -location (FGGE only)

    0 = "Data comes from an overpass on which location was not computed"
    1 = "Location was computed using two passes on one satellite"
    2 = "Location was computed using two passes, one for each of two satellites"
    3 = "Location was computed using one pass only"

14. Eastward velocity in cm/sec (Patterson only)
15. Northward velocity in cm/sec (Patterson only)
16. Scaled eastward acceleration in cm/sec**2 * 10**6 (Patterson only)
17. Scaled northward acceleration in cm/sec**2 * 10**6 (Patterson only)
18. QC flag - processed level IIb drifters (Patterson only)

    0 = "Value is within a data gap 12 hours or more"
    1 = "Value is not within a data gap"

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDFGGE
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program will copy the contents of a FGGE tape received from the NASA Climate Data System or will allow ingest of specified time periods, parameters, or latitude/longitude limits. Dump mode will produce 2 files: an information file for the user's reference, containing header information and information on the tape data files, and a second file which matches tape dates to their locations on the tape (to speed later processing). It is suggested that a dump precede the first ingest. Ingest mode produces one file per time period and parameter, to a user-specified directory. The file names are always of the form : YYMMDDHH (i.e. 79052612 for May 26, 1979 at 1200 GMT); the file type for the mapping file generated by the dump is "FGGELIST", while the file type for the ingested data files is a one-letter parameter designation followed by the word "DATA" (i.e. "UDATA", "VDATA" for u and v wind components). The program currently supports ingestion of the following parameters:

U = u (zonal) winds
V = v (meridional) winds
W = vertical velocity
H = geopotential height
T = temperature
R = relative humidity
P = pressure

**PARAMETERS:**
(1) TAPE is the tape drive being used (e.g. MFA0 on the OCEAN1 node of the Laboratory for Hydrospheric Processes' local area Vax cluster).
(2) MODE is the operation to be executed (mode = 1 to "dump" and mode = 2 to "ingest").
(3) OUTFILE is the file name for "dump" mode output.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** RDFOCAL
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDFOCAL is used to extract and display the data parameters derived from the FOCAL ship-of-opportunity XBT data set. The user can specify the range of latitudes and longitudes, the time limits and the parameter(s) of interest. The listing can be output to the screen, a file or both. If the data is listed to the screen, the user is given the option of discontinuing the listing after each page and whether or not to save the listing as OUTFILE (definition given below). The listing will automatically include the location and time of the observation and any of the following quantities that are selected:

SST = sea surface temperature, degrees C
HMIX = mixed layer depth, meters
H(25) = depth of the 25 degrees C isotherm, meters
H(22.5) = depth of the 22.5 degrees C isotherm, meters
H(20) = depth of the 20 degrees C isotherm, meters
H(17.5) = depth of the 17.5 degrees C isotherm, meters
H(16) = depth of the 16 degrees C isotherm, meters
H(15) = depth of the 15 degrees C isotherm, meters
H(14) = depth of the 14 degrees C isotherm, meters
H(13) = depth of the 13 degrees C isotherm, meters
H(12) = depth of the 12 degrees C isotherm, meters
H(11) = depth of the 11 degrees C isotherm, meters
CT300 = mean temperature, surface to 300 meters, degrees C
CT400 = mean temperature, surface to 400 meters, degrees C

**PARAMETERS:**
(1) INFILE is the filename of the indexed data. The default is FOCAL$DIR:FILE10IX.DATA.
(2) LAT is the range of station latitudes desired (-90 (S) to 90 (N)).
(3) LON is the range of station longitudes desired (-180 (W) to 180 (E)).
(4) SFLAG determines whether the data is listed in order of increasing latitude (= 1), longitude (= 2) or chronologically (= 3).
(5) OUTFILE is the name of the ASCII file to be generated. If the null value, "", is given, no ASCII file will be created.
(6) PRMFLAG determines whether or not a quantity will be included in the list. A zero input excludes the parameter and a 1 includes it.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDFRENSD
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDFRENSD is used to list French cruise station data that have been indexed with IXFRENSD. The data records can be queried by location and time using the first menu. The program will list all stations that satisfy the space-time criteria and will pause each time the terminal screen is filled (20 records) to allow the user to select a station, continue, or return to the menu. Once a station is selected, a second menu will allow for the creation of an ASCII file, the selection of a depth range of interest, and the selection of observed depth parameters. Once this menu is executed, the program allows the user to return to the first menu, return to the current record listing or exit the program. The data are always listed in discrete groups of 20, or less if there are fewer than 20, and are numbered sequentially beginning with 1.

**PARAMETERS:**
First Menu
(1) INFILE is the index filename. An example would be

HYD_DATA:FRENCH_TROP_SD.DAT

which is the French tropical station data set (based on 10 cruises, 1979-1986). ingested using IXFRENSD. Note that the HYD_DATA is a logical name. The filename (FRENCH_TROP_SD.DAT) is a dummy name; it doesn't exist on disk. The files actually used are FRENCH_TROP_SD1.DAT (an index file) and FRENCH_TROP_-SD2.DAT (a relative file), each created by IXFRENSD.
(2) LAT is the latitude range to be surveyed (-90 to 90).
(3) LON is the longitude range to be surveyed (-180 to 180).
(4) DATE is the time range to be surveyed. Input is in a YYMMDD format.
(5) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).
(6) LISTFILE is the filename of the ASCII station listing. A "" input results in no file being created.

Second Menu
(1) OFLAG is the output flag (0 for no ASCII file, 1 for an ASCII file listing).
(2) OUTFILE is the name of the output ASCII file to be created if OFLAG = 1.
(3) DEPTH is the depth range in meters for the data to list (minimum and maximum depths, respectively).
(4) OBSFLAG are the flags for whether to display specific observed depth data. If OBSFLAG(1) is 0, it will turn off the observed listing of all fields, and any other values entered will be ignored. If OBSFLAG(1) is 1, the values will be read for

elements 2 through 19. A "0" entered for any of elements 2-19 of OBSFLAG indicate that this field should NOT be read. A "1" entered for any of elements 2-19 of OBSFLAG indicates that this field should be read. Elements 2-19 represent the following fields:

2 = Temperature
3 = Salinity
4 = Dissolved Phosphorus
5 = Dissolved Oxygen
6 = Saturation Oxygen
7 = Nitrite
8 = Nitrate
9 = Silicate
10 = Ammonium
11 = Chlorophyll
12 = Phaeophytin
13 = Primary productivity
14 = Partial Nitrogen
15 = Partial Phosphorus
16 = Atmospheric Carbon Dioxide
17 = Total Carbon Dioxide
18 = Light
19 = pH

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDFRSDBA
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDFRSDBA is used to list French cruise station data that have been indexed with IXFRENSD. This version has a single tutor screen and is therefore runable in a batch mode. The data records can be queried by location and time and the outputs for station and data listings sent to separate files. The program will list all stations that satisfy the space-time criteria.

**PARAMETERS:**
(1) INFILE is the index filename. An example would be

HYD_DATA:FRENCH_TROP_SD.DAT

which is the French tropical station data set (based on 10 cruises, 1979-1986) ingested using IXFRENSD. Note that the HYD_DATA is a logical name. The filename (FRENCH_TROP_SD.DAT) is a dummy name; it doesn't exist on disk. The files actually used are FRENCH_TROP_SD1.DAT (an index file) and FRENCH_TROP_-SD2.DAT (a relative file), each created by IXFRENSD.

(2) LAT is the latitude range to be surveyed (-90 to 90).
(3) LON is the longitude range to be surveyed (-180 to 180).
(4) SDATE is the array of start times for the ranges to be surveyed. Input is in a YYMMDD format.
(5) EDATE is the array of end times for the ranges to be surveyed. Input is in a YYMMDD format.
(6) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).
(7) LISTFILE is the filename of the optional output ASCII station listing.
(8) OUTFILE is the name of the optional output ASCII file containing observed depth data.
(9) DEPTH is the depth range in meters for the data to list (minimum and maximum depths, respectively).
(10) OBSFLAG are the flags for whether to display specific observed depth data. If OBSFLAG(1) is 0, it will turn off the observed listing of all fields, and any other values entered will be ignored. If OBSFLAG(1) is 1, the values will be read for elements 2 through 19. A "0" entered for any of elements 2-19 of OBSFLAG indicate that this field should NOT be read. A "1" entered for any of elements 2-19 of OBSFLAG indicates that this field should be read. Elements 2-19 represent the following fields:

2 = Temperature
3 = Salinity
4 = Dissolved Phosphorus
5 = Dissolved Oxygen
6 = Saturation Oxygen

7 = Nitrite
8 = Nitrate
9 = Silicate
10 = Ammonium
11 = Chlorophyll
12 = Phaeophytin
13 = Primary productivity
14 = Partial Nitrogen
15 = Partial Phosphorus
16 = Atmospheric Carbon Dioxide
17 = Total Carbon Dioxide
18 = Light
19 = pH

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNCCLM
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNCCLM is used to list temperature data from the NODC Climatological Atlas of the World Ocean, Monthly Analysis (see IXNCCLM). The listing can be output to the terminal and, optionally, to an ASCII file. The query can be made by location, month and standard depth. The program allows the user to roam the output if the area is larger than what can be displayed on the screen. The options are Exit (e), Quit (q, return to menu), Up# (u#), Down# (d#), Left# (l#), and Right# (r#) where # is the number of columns or rows to shift. Since the data set has a one degree resolution, each column and row corresponds to one degree.

**PARAMETERS:**
(1) LAT is the latitude range to be included in the listing with limits of -90 to 90.
(2) LON is the longitude range to be included in the listing with limits of -180 to 180.
(3) DEPLV is the standard depth to be listed. Inputs range from 1 to 19 as defined by the following table:

| Level | Depth (m) | Level | Depth (m) |
|---|---|---|---|
| 1 | 0 | 11 | 250 |
| 2 | 10 | 12 | 300 |
| 3 | 20 | 13 | 400 |
| 4 | 30 | 14 | 500 |
| 5 | 50 | 15 | 600 |
| 6 | 75 | 16 | 700 |
| 7 | 100 | 17 | 800 |
| 8 | 125 | 18 | 900 |
| 9 | 150 | 19 | 1000 |
| 10 | 200 | | |

(4) MONTH is the month to be listed (1-Jan, 2-Feb,..., 12-Dec).
(5) INFILE is the index file generated by IXNCCLM from which the data is retrieved. The default is CLM_DATA:NC_MONTH.DAT where CLM_DATA is a SEAPAK logical name.
(6) OUTFILE is the filename of the ASCII file to be created. If "" is input, no file will be generated.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNCMDBA
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNCMDBA is the batch version of RDNODCMD. It is used to list NODC current meter data (NODC file designator F015) sets from index files created by IXNODCMD. Eight data parameters may be selected and are record number, date, time, u_component, v_component, temperature, pressure and conductivity (or salinity). Since it runs in the batch mode, it has only a single tutor menu. Parameters in the menu allow the user to specify ranges of latitude, longitude, date, depth and the geophysical variable. The data can also be subsampled. Two output files can be obtained. One is a listing of stations that satisfy the query criteria. This file can be used in PLOTLOC to plot the station locations on an image. The second file type is a listing of the data for all the stations. The order of listing is determined by the SFLAG parameter. Both output files are in ASCII format. See RDNODCMD for more information.

**PARAMETERS:**

(1) LAT is the range of latitude to be listed (-90 to 90).

(2) LON is the range of longitude to be listed (-180(W) to 180(E)).

(3) TDATE is the time interval to be listed (YYMMDD format).

(4) DEPTH is the depth interval to be listed.

(5) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE, 4-DEPTH).

(6) INFILE is the input file name. Examples are CUR_DATA:-NC_AT_TROP.DAT (NODC Atlantic tropical current data) and CUR_DATA:NC_FG_MD.DAT (NODC FGGE current meter data, NODC Environmental Information Bulletin No. 87-2). Here the CUR_DATA is a logical name and the file name (following CUR_DATA:) is a dummy file; it doesn't exist on the disk. The files actually used in the first case are NC_AT_TROP1.DAT and NC_AT_TROP2.DAT which are created by IXNODCMD. Each data set contains one index file (NC_AT_TROP1.DAT) and one relative file (NC_AT_TROP2.DAT).

(7) LISTFILE allows for the creation of an ASCII file of the station listing. A "" input results in no file being created. Definitions of listing column titles:

NO = record number
LAT = current meter latitude
LON = current meter longitude
S_DATE = record start date
E_DATE = record end date
BOT_DP = bottom depth
METER_DP = meter depth
TOT_REC = total number of samples/records.
TEXT = comments provided with the data.

(8) OUTFILE is the output data file name. If the null default is used, no output data file will be created.
(9) DSPSTEP is the subsample interval, e.g. 1 = every sample, 2 = every other sample.
(10) MFLAG determines which parameters will be listed (0 = no, 1 = yes). All eight parameters are listed in the menu.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNCSDBA
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNCSDBA is the batch version of RDNODCSD. It is used to list NODC station data (hydrocast and low resolution CTD/STD). Since it runs in the batch mode, it has only a single tutor menu. Parameters in the menu allow the user to specify ranges of latitude, longitude, date, depth and the geophysical variable. Depths are both observed and standard (when available). Two output files can be obtained. One is a listing of stations that satisfy the query criteria. This file can be used in PLOTLOC to plot the station locations on an image. The second file type is a listing of the data for all the stations. The order of listing is determined by the SFLAG parameter. Both output files are in ASCII format. See RDNCSDBA for more information.

**PARAMETERS:**
(1) LAT is the latitude range to be listed (-90 to 90)
(2) LON is the longitude range to be listed (-180(W) to 180(E)).
(3) SDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(4) EDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(5) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE).
(6) INFILE is the name of the input file. Examples are 1. HYD_DATA:NC_AT_TROP.DAT (Atlantic tropical region), HYD_DATA:-NC_FG_SD.DAT (FGGE oceanographic hydrocast data, NODC Environmental Information Bulletin No. 87-2) and HYD_DATA:-NC_FG_CS.DAT (FGGE conductivity/salinity/temperature/depth data), where the HYD_DATA is a logical name. The file name (following the HYD_DATA:) is a dummy file; it doesn't exist on the disk. The files actually used, for example, in the NC_AT_TROP data set are NC_AT_TROP1.DAT, NC_AT_TROP2.DAT and NC_AT_TROP3.DAT which are the three index files created by IXNODCSD.
(7) LISTFILE allows for the creation of an ASCII file of the station listing. A "" input results in no file being created. Definitions of record listing titles:

    REC_NO = record number
    LAT = station latitude
    LON = station longitude
    DATE = station date
    TIME = time station data was collected
    BOT_DP = bottom depth
    MAX_DP = depth of deepest sample
    WTP = Secchi depth

(8) OUTFILE is the output data file name.
(9) DEPTH is the depth range to be listed.

(10) STDFLAG is used to select standard depth parameters (temperature, salinity, sigma-t, sound speed, oxygen concentration). The menu requires an entry for each with 0 = no and 1 = yes. If the first item, "List standard depth data", = 0, no standard depth data will be listed.

(11) OBSFLAG is used to select the observed parameters to be listed. The selection is:

1. List observed data
2. Temperature
3. Salinity
4. Sigma-t
5. Sound speed
6. Oxygen
7. Inorganic phosphorous
8. Total phosphorous
9. Silicate
10. Nitrite
11. Nitrate
12. pH

If the first entry, "List observed depth data", = 0, none of the observed quantities will be listed irregardless of their settings. If this entry = 1, then menu items 2 through 11 will be checked. For these parameters, a value of 1 designates the variable as one to be listed and a 0 suspends listing. If no value is provided, a value of 1 is assumed.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNCSDBA_CD
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNCSDBA_CD is the batch version of RDNODCSD_CD. It is used to list NODC station data (hydrocast and low resolution CTD/STD) that have been indexed with IXNODCSD_CD. It is assumed that the original data were stored on a CD-ROM produced by the NODC. Since it runs in the batch mode, it has only a single tutor menu. Parameters in the menu allow the user to specify ranges of latitude, longitude and date. Two output files can be obtained. One is a listing of stations that satisfy the query criteria. This file can be used in PLOTLOC to plot the station locations on an image. The second file type is a listing of the data for all the stations, compatible with SEAPAK programs ASC2GEM, DENSPROF and MEANPROF. The order of listing is determined by the SFLAG parameter. Both output files are in ASCII format.

**PARAMETERS:**
(1) LAT is the latitude range to be listed (-90 to 90)
(2) LON is the longitude range to be listed (-180(W) to 180(E)).
(3) SDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(4) EDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(5) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE).
(6) INFILE is the name of the input file. For example, PAC_STD.DAT for the Pacific CTD data or PAC_SD2 for the Pacific Nansen cast data from the NODC CD-ROM. The file name represents the two actual files (indexed and relative) containing data: PAC_STD1.DAT and PAC_STD2.DAT for the CTD data and PAC_SD21.DAT and PAC_SD22.DAT for the Nansen cast data.
(7) LISTFILE allows for the creation of an ASCII file of the station listing. This file can be used in PLOTLOC to plot the station locations on an image. A "" input results in no file being created. Definitions of record listing titles:

    REC_NO = record number
    LAT = station latitude
    LON = station longitude
    DATE = station date
    TIME = time station data was collected
    TOT_REC = total number of data records

(8) OUTFILE is the output data file name.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNODCDR
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCDR is used to list NODC drifter data (NODC file designator F156) from an indexed file and a relative data file created with IXNODCDR. Seven data parameters may be selected: record number, date, time, surface temperature, salinity, bottom depth and air temperature. The program can be run interactively or in a batch mode (by specifying delimiter ¦runtype=batch¦ immediately following the "run" command in the tutor screen). When running in a batch mode, all drifters matching the space/time criteria are selected and their data written to the output file. For both modes, the data records can be queried and sorted by location and time. Up to 50 time ranges can be entered during a single run. These will be run in order during program execution. For interactive mode, the qualifying records are listed to the terminal. The listing automatically stops once the terminal screen is filled (20 records). At this point, the user may select a drifter or list another page of drifters. Once a drifter is selected, the first page of its data is displayed. The user may continue the listing, stop the listing (thus printing the contents to OUTFILE) or restart the listing at a different point. If stop is selected, the user is given the choice to return to the first menu, return to the drifter listing or to proceed to the next time period (if any). Once the last page of drifters is listed, the continue option returns the user to the first menu.

**PARAMETERS:**
(1) INFILE is the index filename. An example would be SF:-NC_SEQ_FOC_DR.DAT, which is the NODC SEQUAL/FOCAL data set which has been ingested using IXXBT. Note that the SF: is a logical name. The filename (NC_SEQ_FOC_DR.DAT) is a dummy name; it doesn't exist on disk. The files actually used are NC_SEQ_FOC_DR1.DAT (an index file) and NC_SEQ_FOC_DR2.DAT (a relative file), each created by IXNODCDR.
(2) LAT is the latitude range to be surveyed (-90 to 90).
(3) LON is the longitude range to be surveyed (-180 to 180).
(4) SDATE is the array of up to 50 start dates for the time ranges to be surveyed. Input is in a YYMMDD format.
(5) EDATE is the array of up to 50 end dates for the time ranges to be surveyed. Input is in a YYMMDD format.
(6) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).
(7) LISTFILE is the filename of the ASCII station listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.
(8) DSPSTEP is the output display interval, i.e. an input of 2 means to display every other point along the drift.

(9) OUTFILE is the filename for the output ASCII data listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(10) MFLAG is a flag for whether each drifter parameter is to be ingested or not. Enter a 0 for a given parameter to skip it, or a 1 to ingest it. The parameters are as follows:

1. Record number
2. Date
3. Time
4. Surface temperature
5. Salinity
6. Bottom depth
7. Air temperature

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNODCMD
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCMD is used to list NODC current meter data (NODC file designator F015) sets from index files created by IXNODCMD. Eight data parameters may be selected and are record number, date, time, u_component, v_component, temperature, pressure and conductivity (or salinity). The data records can be queried and sorted by location, time, and depth using the first menu. The qualifying records are listed to the terminal. The listing automatically stops once the terminal screen is filled (20 records). At this point, the user may select a data set or list another page of data sets. Once a data set is selected, a second menu provides for subsampling, output to an ASCII file and the selection of parameters. Upon execution of the second menu, the first page of data is displayed. The user may continue the listing, stop the listing or restart the listing. If stop is selected, the user is given the choice to return to the first menu, return to the data set listing or to exit the program. Once the last page of data sets is listed, the continue option returns the user to the first menu.

**PARAMETERS:**
First Menu
(1) LAT is the range of latitude to be listed (-90 to 90).
(2) LON is the range of longitude to be listed (-180(W) to 180(E)).
(3) TDATE is the time interval to be listed (YYMMDD format).
(4) DEPTH is the depth interval to be listed.
(5) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE, 4-DEPTH).
(6) INFILE is the input file name. Examples are CUR_DATA:-NC_AT_TROP.DAT (NODC Atlantic tropical current data) and CUR_DATA:NC_FG_MD.DAT (NODC FGGE current meter data, NODC Environmental Information Bulletin No. 87-2). Here the CUR_DATA is a logical name and the file name (following CUR_DATA:) is a dummy file; it doesn't exist on the disk. The files actually used in the first case are NC_AT_TROP1.DAT and NC_AT_TROP2.DAT which are created by IXNODCMD. Each data set contains one index file (NC_AT_TROP1.DAT) and one relative file (NC_AT_TROP2.DAT).
(7) LISTFILE allows for the creation of an ASCII file of the station listing. A "" input results in no file being created. Definitions of listing column titles:

NO = record number (1 - 20)
LAT = current meter latitude
LON = current meter longitude
S_DATE = record start date
E_DATE = record end date

BOT_DP = bottom depth
METER_DP = meter depth
TOT_REC = total number of samples/records.
TEXT = comments provided with the data.

Second Menu

(1) DSPSTEP is the subsample interval, e.g. 1 = every sample, 2 = every other sample.

(2) OFLAG determines if an ASCII file is to be generated (0 = no, 1 = yes).

(3) OUTFILE is the output file name, if OFLAG = 1.

(4) MFLAG determines which parameters will be listed (0 = no, 1 = yes). All eight parameters are listed in the menu.

**IIS BUTTON DEFINITION:**

No buttons are used.

**PROGRAM NAME:** RDNODCPG
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCPG is used to list NODC pressure gauge data (NODC file designator F017) from an index file and a relative data file created with IXNODCPG. Five data parameters may be selected: record number, date, time, total pressure and temperature. The program can be run interactively or in a batch mode (by specifying delimiter ¦runtype=batch¦ immediately following the "run" command in the tutor screen). When running in a batch mode, all gauges matching the space/time criteria are selected and their data written to the output file. For both modes, the data records can be queried and sorted by location and time. Up to 50 time ranges can be entered during a single run. These will be run in order during program execution. For interactive mode, the qualifying records are listed to the terminal. The listing automatically stops once the terminal screen is filled (20 records). At this point, the user may select a gauge or list another page of drifters. Once a gauge is selected, the first page of its data is displayed. The user may continue the listing, stop the listing (thus printing the contents to OUTFILE) or restart the listing at a different point. If stop is selected, the user is given the choice to return to the first menu, return to the gauge listing or to proceed to the next time period (if any). Once the last page of gauges is listed, the continue option returns the user to the first menu.

**PARAMETERS:**

(1) INFILE is the index filename. An example would be SF:NC_SEQ_-FOC_PG.DAT, which is the NODC SEQUAL/FOCAL data set which has been ingested using IXNODCPG. Note that the SF: is a logical name. The filename (NC_SEQ_FOC_PG.DAT) is a dummy name; it doesn't exist on disk. The files actually used are NC_SEQ_-FOC_PG1.DAT (an index file) and NC_SEQ_FOC_PG2.DAT (a relative file), each created by IXNODCPG.

(2) LAT is the latitude range to be surveyed (-90 to 90).

(3) LON is the longitude range to be surveyed (-180 to 180).

(4) SDATE is the array of up to 50 start dates for the time ranges to be surveyed. Input is in a YYMMDD format.

(5) EDATE is the array of up to 50 end dates for the time ranges to be surveyed. Input is in a YYMMDD format.

(6) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE, 4-DEPTH).

(7) LISTFILE is the filename of the ASCII station listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(8) DSPSTEP is the output display interval, i.e. an input of 2 means to display every other point in the gauge series.

(9) OUTFILE is the filename for the output ASCII data listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(10) MFLAG is a flag for whether each gauge parameter is to be ingested or not. Enter a 0 for a given parameter to skip it, or a 1 to ingest it. The parameters are as follows:

1. Record number
2. Date
3. Time
4. Total pressure
5. Temperature

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNODCSD
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCSD lists NODC station data (hydrocast and low resolution CTD/STD) that has been indexed with IXNODCSD. Observations at observed depths and estimated values at standard depths (when available) may be listed. The data records may be queried by location and time using the first menu. The program will list all stations that satisfy the space-time criteria and will pause each time the terminal screen is filled (20 records) to allow the user to select a station, continue, or return to the menu. Once a station is selected, a second menu will allow for the creation of an ASCII file, the selection of depth range of interest, and the selection of standard depth parameters and observed parameters. Once this menu is executed, the program allows the user to return to the first menu, return to the current record listing or exit the program. If standard depth data is requested and none exists, the program will list the observed values, if requested, and will return to the first menu. The data is always listed in discrete groups of 20 or less if there are fewer than 20 and are numbered sequentially beginning with 1.

**PARAMETERS:**
First Menu
(1) LAT is the latitude range to be listed (-90 to 90)
(2) LON is the longitude range to be listed (-180(W) to 180(E)).
(3) DATE is the time period of interest (YYMMDD format)
(4) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE).
(5) INFILE is the name of the input file. Examples are 1. HYD_DATA:NC_AT_TROP.DAT (Atlantic tropical region), HYD_DATA:-NC_FG_SD.DAT (FGGE oceanographic hydrocast data, NODC Environmental Information Bulletin No. 87-2) and HYD_DATA:-NC_FG_CS.DAT (FGGE conductivity/salinity/temperature/depth data), where the HYD_DATA is a logical name. The file name (following the HYD_DATA:) is a dummy file; it doesn't exist on the disk. The files actually used, for example, in the NC_AT_TROP data set are NC_AT_TROP1.DAT, NC_AT_TROP2.DAT and NC_AT_TROP3.DAT which are the three index files created by IXNODCSD.
(6) LISTFILE allows for the creation of an ASCII file of the station listing. A "" input results in no file being created. Definitions of record listing titles:

REC_NO = record number (1 - 20)
LAT = station latitude
LON = station longitude
DATE = station date
TIME = time station data was collected
BOT_DP = bottom depth
MAX_DP = depth of deepest sample

WTP = Secchi depth

Second Menu

(1) OFLAG determines if an ASCII file is to be created (0 = no, 1 = yes).

(2) OUTFILE is the output file name, if OFLAG = 1.

(3) DEPTH is the depth range to be listed.

(4) STDFLAG is used to select standard depth parameters (temperature, salinity, sigma-t, sound speed, oxygen concentration). The menu requires an entry for each with 0 = no and 1 = yes. If the first item, "Display standard depth data", = 0, no standard depth data will be displayed to the terminal.

(5) OBSFLAG is used to select the observed parameters to be listed. The selection is temperature, salinity, sigma-t, sound speed, inorganic phosphorous, total phosphorus, silicate, nitrite, nitrate and pH. If the first entry, "Display observed depth data", = 0, none of the observed quantities will be displayed to the terminal.

**IIS BUTTON DEFINITION:**

No buttons are used.

**PROGRAM NAME:** RDNODCSD_CD
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCSD_CD lists NODC station data (hydrocast and low resolution CTD/STD) that have been indexed with IXNODCSD_CD. It is assumed that the original data were stored on a CD-ROM produced by the NODC. The data records may be queried by location and time using the first menu. The program will list all stations that satisfy the space-time criteria and will pause each time the terminal screen is filled (20 records) to allow the user to select a station, continue, or return to the menu. Once a station is selected, a second menu will allow for the creation of an ASCII file with the Nansen cast or CTD data, which is compatible with SEAPAK programs ASC2GEM, DENSPROF and MEANPROF. Once this menu is executed, the program allows the user to return to the first menu, return to the current record listing or exit the program. The data is always listed in discrete groups of 20 or less if there are fewer than 20 and are numbered sequentially beginning with 1.

**PARAMETERS:**
First Menu
(1) LAT is the latitude range to be listed (-90 to 90).
(2) LON is the longitude range to be listed (-180(W) to 180(E)).
(3) TDATE are the start/end times for the periods of interest (YYMMDD format), listed consecutively (start for time 1, end for time 1, start for time 2, etc). Up to 25 ranges may be specified.
(4) SFLAG determines the sorting order (1-LAT, 2-LON, 3-DATE).
(5) INFILE is the name of the input file. For example, PAC_STD.DAT for the Pacific CTD data or PAC_SD2 for the Pacific Nansen cast data from the NODC CD-ROM. The file name represents the two actual files (indexed and relative) containing data: PAC_STD1.DAT and PAC_STD2.DAT for the CTD data and PAC_SD21.DAT and PAC_SD22.DAT for the Nansen cast data.
(6) LISTFILE is the name of an ASCII output file to contain the list of stations resulting from the user's query. This file can be used in PLOTLOC to plot the station locations on an image. A "" input results in no file being created. Definitions of record listing titles:

REC_NO = record number (1 - 20)
LAT = station latitude
LON = station longitude
DATE = station date
TIME = time station data was collected
TOT_REC = total number of data records

Second Menu

(1) OFLAG determines if an ASCII file is to be created (0 = no, 1 = yes).

(2) OUTFILE is the output file name, if OFLAG = 1.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDNODCWT
**DATE:** 4/15/91
**MENU:** NODCLIST

**DESCRIPTION:** RDNODCWT is used to list and, optionally, create an ASCII file of Secchi depths using indexed data created by IXNODCWT. The NODC Worldwide Ocean Water Color/Water Transparency data set (NODC Environmental Information Bulletin No. 87-1) is used. The user can query and sort by location and time. The listing to the terminal is halted when the display is full and the user has the option of continuing or returning to the menu. The listing includes the sequential number (REC_NO), the latitude (LAT), the longitude (LON), the DATE, the TIME, the bottom depth (BOT_DP), and the Secchi depth (WTP).

**PARAMETERS:**
(1) LAT is the latitude range of interest (-90 (S) to 90 (N)).
(2) LON is the longitude range of interest (-180 (W) to 180 (E)).
(3) DATE is the time period of interest (YYMMDD format).
(4) SFLAG is the sorting criterion (1-LAT, 2-LON, 3-DATE).
(5) INFILE is the input file name. WTP_DATA:NC_WORLD.DAT is the default where the WTP_DATA is a logical name and the file name (NC_WORLD.DAT) is a dummy file; it doesn't exist on the disk. The file actually used is NC_WORLD1.DAT which was created by IXNODCWT.
(6) OUTFILE is the output file name. If no ASCII file is to be created, "" should be entered.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDSFCTD
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDSFCTD is used to list SEQUAL experiment CTD data or VCTD data from Dr. Perkins of NORDA, from an index file and a relative data file created with IXSFCTD. For CTD's, five data parameters may be selected and are record number, date, time, pressure, temperature, salinity and oxygen. For VCTD's, u and v current speeds are also available but no oxygen data is available. The program can be run interactively or in a batch mode (by specifying delimiter ¦runtype=batch¦ immediately following the "run" command in the tutor screen). When running in a batch mode, all CTD's matching the space/time criteria are selected and their data written to the output file. For both modes, the data records can be queried and sorted by location and time. Up to 50 time ranges can be entered during a single run. These will be run in order during program execution. For interactive mode, the qualifying records are listed to the terminal. The listing automatically stops once the terminal screen is filled (20 records). At this point, the user may select a CTD or list another page of CTD's. Once a CTD is selected, the first page of its data is displayed. The user may continue the listing, stop the listing (thus printing the contents to OUTFILE) or restart the listing at a different point. If stop is selected, the user is given the choice to return to the first menu, return to the CTD listing or to proceed to the next time period (if any). Once the last page of CTD's is listed, the continue option returns the user to the first menu.

**PARAMETERS:**
(1) INFILE is the index filename. An example would be SF:SEQ_FOC_CTD.DAT, which is the SEQUAL/FOCAL data set which has been ingested using IXSCTD. Note that the SF: is a logical name. The filename (SEQ_FOC_CTD.DAT) is a dummy name; it doesn't exist on disk. The files actually used are SEQ_FOC_CTD1.DAT (an index file) and SEQ_FOC_CTD2.DAT (a relative file), each created by IXSFCTD.
(2) LAT is the latitude range to be surveyed (-90 to 90).
(3) LON is the longitude range to be surveyed (-180 to 180).
(4) SDATE is the array of up to 50 start dates for the time ranges to be surveyed. Input is in a YYMMDD format.
(5) EDATE is the array of up to 50 end dates for the time ranges to be surveyed. Input is in a YYMMDD format.
(6) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE, 4-PRESSURE).
(7) LISTFILE is the filename of the ASCII station listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(8) DSPSTEP is the output display interval, i.e. an input of 2 means to display every other point in pressure.

(9) OUTFILE is the filename for the output ASCII data listing. A null input results in no file being created. Note that either OUTFILE or LISTFILE must be input in order for the program to run.

(10) MFLAG is a flag for whether each CTD parameter is to be ingested or not. Enter a 0 for a given parameter to skip it, or a 1 to ingest it. The parameters are as follows:

1. Record number
2. Pressure
3. Temperature
4. Salinity
5. Oxygen (CTD only)
6. U current (VCTD only)
7. V current (VCTD only)

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDSKDBA
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDSKDBA is the batch version of RDSKDWAY. It is used to list station data (hydrocast) received from Skidaway Institute of Oceanography. Since it runs in the batch mode, it has only a single tutor menu. Parameters in the menu allow the user to specify ranges of latitude, longitude, date, depth and the geophysical variables. Two output files can be obtained. One is a listing of stations that satisfies the query criteria. This file can be used in PLOTLOC to plot the station locations on an image. The second file type is a listing of the data for all the stations. The order of listing is determined by the SFLAG parameter. Both files are in ASCII format. See RDSKDWAY for more information.

**PARAMETERS:**

(1) LAT is the latitude range of interest (-90 (S) to 90 (N)).
(2) LON is the longitude range of interest (-180 (W) to 180 (E)).
(3) DATE is the time period of interest (YYMMDD format).
(4) SFLAG is the sort flag (1-LAT, 2-LON, 3-DATE).
(5) INFILE is the input file name. An example is HYD_DATA:SKD_-SA.DAT which contains the data from five synoptic cruises from the fall of 1978 to the fall of 1979. These cruises surveyed the continental shelf from Cape Fear to Cape Canaveral. The HYD_DATA is a logical name and the file name (following the HYD_DATA:) is a dummy file; it doesn't exist on the disk, but instead, the files actually used are SKD_SA1.DAT, and SKD_SA2.DAT which were created by IXSKDWAY.
(6) LISTFILE allows the creation of an ASCII file of the listing. If the null value default is not modified, no file will be created. Data set listing title definitions:

    NO = listing number
    STA_NO = station number
    LAT = latitude of the station
    LON = longitude of the station
    DATE = date of the station
    TIME = time of the station
    BOT_DP = bottom depth

(7) OUTFILE is the output data file name. If the null value default is not modified, no file will be created.
(8) DEPTH is the depth range of interest.
(9) OBSFLAG is used to select the parameters to be listed. The menu is:

    1. List observed depth data
    2. TEMPERATURE
    3. SALINITY
    4. OXYGEN

5. PHOSPHORUS
6. NITRITE
7. NITRATE
8. SILICATE

If the first entry, "List observed depth data", = 0, none of the observed quantities will be listed regardless of their settings. If this entry = 1, then menu items 2 through 8 will be checked. For these parameters, a value of 1 designates the variable as one to be listed and a 0 suspends listing. If no value is provided, a value of 1 is assumed.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDSKDWAY
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDSKDWAY is used to list and, optionally, create an ASCII file of hydrographic data from Skidaway Institute of Oceanography which has been indexed using IXSKDWAY. The data records may be queried by location and time using the first menu. The program will list all stations that satisfy the space-time criteria and will pause each time the terminal screen is filled (20 records) to allow the user to select a station, continue, or return to the menu. Once a station is selected, a second menu will allow for the creation of an ASCII file, the selection of depth range of interest, and the selection of observed parameters. Once this menu is executed, the program allows the user to return to the first menu, return to the current station listing or exit the program. The data is always listed in discrete groups of 20 or less if there are fewer than 20 and are numbered sequentially beginning with 1 for each page.

**PARAMETERS:**
First Menu
(1) INFILE is the input file name. An example is HYD_DATA:SKD_-SA.DAT which contains the data from five synoptic cruises from the fall of 1978 to the fall of 1979. These cruises surveyed the continental shelf from Cape Fear to Cape Canaveral. The HYD_DATA is a logical name and the file name (following the HYD_DATA:) is a dummy file; it doesn't exist on the disk, but instead, the files actually used are SKD_SA1.DAT, and SKD_SA2.DAT which were created by IXSKDWAY.
(2) LAT is the latitude range of interest (-90 (S) to 90 (N)).
(3) LON is the longitude range of interest (-180 (W) to 180 (E)).
(4) DATE is the time period of interest (YYMMDD format).
(5) SFLAG is the sort flag (1-LAT, 2-LON, 3-DATE).
(6) LISTFILE allow the creation of an ASCII file of the listing. A "" input results in no file being created. Data set listing title definitions:

NO = listing number
STA_NO = station number
LAT = latitude of the station
LON = longitude of the station
DATE = date of the station
TIME = time of the station
BOT_DP = bottom depth

Second Menu
(1) OFLAG is used to create an ASCII file (0 = no, 1 = yes).
(2) OUTFILE is the output file name, if OFLAG = 1.
(3) DEPTH is the depth range of interest.
(4) OBSFLAG is used to select the parameters to be listed.

1. Display observed depth data
2. TEMPERATURE
3. SALINITY
4. OXYGEN
5. PHOSPHORUS
6. NITRITE
7. NITRATE
8. SILICATE

If selection 1 (Display observed depth data) is not selected, no data will be listed to the terminal (0 = do not display, 1 = display).

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDSOADS
**DATE:** 11/7/90
**MENU:** NODCLIST

**DESCRIPTION:** This program may be used to examine on the terminal, and output to files, data from NODC's Southern Ocean Data Set (SOADS). SOADS consists of 6,313 hydrographic station data taken south of 27 degrees S from 1906 to 1978. For each requested station, depth levels data may be obtained.

**PARAMETERS:**

(1) STAFILE is a file name, which if specified will create a disk file to contain the header information for the requested stations. If the null value "--" (default) is entered, STAFILE will not be created. The STAFILE output file may be used as input to the program PLOTLOC. The extension ".LST" will be used by default if it is omitted from the file name. The information written for each station includes it's sequence number; latitude and longitude; date and Greenwich Mean Time (GMT); optional, four-character codes each for the station, country/ship, and cruise; number of depth levels for which there are data; depths in meters of the ocean bottom; and a four-digit nutrient code (P_NUT). The P_NUT code indicates the percentage of good nutrient values. The thousands position is for oxygen, the hundreds for silicate, the tens for phosphate, and the units for nitrate. Thus, 0961 indicates that 0 to 10% of the oxygen, 90 to 100% of the silicate, 60 to 70% of phosphate, and 10 to 20% of the nitrate data are available for that station's levels.

(2) LEVFILE is a file name, which if specified will create a disk file to contain data for the requested depth levels of the requested stations. If the null value "--" (default) is entered, LEVILE will not be created. The extension ".LST" will be used by default if it is omitted from the file name. The station sequence number, geocoordinates, date, and four-character code will be written for each station followed by that station's requested levels data. For each level these data include the level number; depth in meters; temperature in degrees centigrade; salinity in parts per thousand; oxygen (O2) in milliliters per liter; and silicate (SIO3), phosphate (PO4), and nitrate (NO2) concentrations in microgram atoms per liter. A value of -9.0 is used to indicate missing data.

(3) SORT is used to specify the variable by which to sort the station header information when displaying it on the terminal or writing it into STAFILE. A value of 1 (default) indicates the latitude, 2 indicates the longitude, and 3 indicates the date.

(4) LAT_RNG is the range of latitudes from which to select stations whose header information is to be displayed on the terminal or written to STAFILE. The default values, -79

(79 S) and -27 (27 S), represent the range for the entire data set.

(5) LON_RNG is the range of longitudes from which to select stations whose header information is to be displayed on the terminal or written to STAFILE. The default values, -180 (180 W) and 180 (180 E), represent the range for the entire data set.

(6) DATE_RNG is the range of dates in YYMMDD format from which to select stations whose header information is to be displayed on the terminal or written to STAFILE. The default values, 60417 (17 Apr 1906) and 781101 (1 Oct 1978), represent the range for the entire data set.

(7) DEP_RNG is the range of depths in meters from which to select the station levels. Only data for levels within this range will be displayed on the terminal or written to LEVFILE. The default values, 0 and 11000, include all possible station levels.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** RDXBT
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDXBT is used to list NODC XBT data (NODC file designator is XBT) or Reverdin (FOCAL) multi-level drifter-as-XBT data from an index file and a relative data file created with IXXBT. The data can be queried by location and time and may be listed at the terminal and, optionally, in an ASCII file. The user has the option of creating an ASCII listing of the stations that satisfy the search criterion. The stations are listed in groups of 20 to the terminal and the user has the option of selecting a station, returning to the menu or continuing with the listing. Once a station is selected, a second menu allows for the creation of an ASCII file of the data.

**PARAMETERS:**
First Menu
(1) INFILE is the index filename. An example would be XBT_DATA:-NC_FG_XBT.DAT, which is the NODC FGGE XBT data set (see NODC Environmental Information Bulletin No. 87-2) which has been ingested using IXXBT. Note that the XBT_DATA is a logical name. The filename (NC_FG_XBT.DAT) is a dummy name; it doesn't exist on disk. The files actually used are NC_FG_-XBT1.DAT (an index file) and NC_FG_XBT2.DAT (a relative file), each created by IXXBT.
(2) LAT is the latitude range to be surveyed (-90 to 90).
(3) LON is the longitude range to be surveyed (-180 to 180).
(4) TDATE is the time range to be surveyed. Input is in a YYMMDD format.
(5) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).
(6) LISTFILE is the filename of the ASCII station listing. A "" input results in no file being created. Definitions of listing column titles:

No. = listing number (1 - 20)
LAT = latitude of station
LON = longitude of station
DATE = date of station
TIME = time of station
BOT_DP = bottom depth
TOT_REC = total number of samples

Second Menu
(1) OFLAG is the output flag (0 for no ASCII file, 1 for an ASCII file listing).
(2) OUTFILE is the name of the output ASCII file to be created if OFLAG = 1.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** RDXBTBA
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** RDXBTBA is the batch version of RDXBT. It is used to list NODC XBT data as well as Reverdin (FOCAL) drifter-as-XBT data. Since it runs in a batch mode, it has only a single tutor menu. Parameters in the menu allow the user to specify ranges of latitude, longitude, and date. Two output files can be obtained. One is a listing of stations that satisfy the query criteria. This file can be used in PLOTLOC to plot the station locations on an image. The second file type is a listing of the data for all the stations. The order of listing is determined by the SFLAG parameter. Both output files are in ASCII format. See RDXBT for more information.

**PARAMETERS:**
(1) LAT is the latitude range to be surveyed (-90 to 90).
(2) LON is the longitude range to be surveyed (-180 to 180).
(3) SDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(4) EDATE is an array of up to 50 start times for the periods of interest (YYMMDD format).
(5) SFLAG is the sorting flag which determines the order in which stations are listed (1-LAT, 2-LON, 3-DATE).
(6) INFILE is the index filename. An example would be XBT_DATA:-NC_FG_XBT.DAT, which is the NODC FGGE XBT data set (see NODC Environmental Information Bulletin No. 87-2) which has been ingested using IXNCXBT. Note that the XBT_DATA is a logical name. The filename (NC_FG_XBT.DAT) is a dummy name; it doesn't exist on the disk. The files actually used are NC_FG_XBT1.DAT (an index file) and NC_FG_XBT2.DAT (a relative file), each created by IXXBT.
(7) LISTFILE is the filename of the ASCII station listing. A "" input results in no file being created. Definitions of listing column titles:

    No. = listing number
    LAT = latitude of station
    LON = longitude of station
    DATE = date of station
    TIME = time of station
    BOT_DP = bottom depth
    TOT_REC = total number of samples

(8) OUTFILE is the name of the output ASCII data file to be created. If the null default is used, no data file will be created.

**IIS BUTTON DEFINITION:**
No buttons are used.

**PROGRAM NAME:** READ
**DATE:** 4/15/91
**MENU:** EXTRACT

**DESCRIPTION:** This proc allows the user to retrieve image data displayed on the IIS at the cursor position. The values may be read as gray levels or in geophysical units corresponding to the image data type specified by the parameter TYPE. The cursor shape may be changed into a cross hair to specify one pixel or into a square to specify an area from which to read values. Four different box sizes are provided with the largest retrieval area being 63 by 63 pixels. The cursor box is moved by the IIS trackball and can be placed anywhere on the image. Additional IIS button functions are provided to: 1) output values to a disk file or printer, 2) invoke the proc LATLON, 3) mark the cursor on a graphics plane, 4) change the graphics plane, 5) list the images currently loaded in the display memories, 6) change the channel being displayed, and 7) drop a new image.

**PARAMETERS:**

(1) TYPE specifies the conversion method (gray levels-to-geophysical) used when obtaining the image values displayed using button A3. This index should correspond to the type of image being displayed. One of the following indices must be entered:

0. Gray level values
1. Pigment concentrations (mg/m3)
2. AVHRR sea surface temperatures (deg C)
3. CZCS sea surface temperatures (deg C)
4. Total radiance values (mW/cm2-um-sr)
5. Rayleigh radiance values (mW/cm2-um-sr)
6. Water radiance values (mW/cm2-um-sr)
7. Aerosol radiance values (mW/cm2-um-sr)
8. Diffuse attenuation values
9. Primary productivity values
10. Epsilon values
11. Bathymetry (m)
12. STATDIS, ENVIMG, or statistical images
13. User-specified, linearly-scaled values

If a "4" is entered, one will be a prompted for the correction option (COR_OPT) and the correction factor (FACTOR), if needed by the selected correction option. If a "13" is entered, one will be prompted for a slope (SLOPE) and intercept (INTCPT) to use when converting gray levels into data values.

(2) PLANE is the number of the graphics plane (1 to 7) to use for marking the cursor position (button A1). This plane may be changed with button C1 once the proc is invoked.

**DYNAMIC PARAMETERS:**

(1) COR_OPT indicates the correction method (model) to use for converting gray levels into total radiances:

1. Gordon single scattering
2. Sturm single scattering
3. Evans scalar or exact multiple scattering
4. User-specified correction factor (see FACTOR)

(2) FACTOR defines the radiance correction factor for the CZCS band (1 to 4) corresponding to the image on which button A3 will be used. FACTOR is used only if COR_OPT=4; otherwise it is ignored.

(3) SLOPE is the slope value of the linear relationship which will be used to convert image gray levels into the data values output by button A3:

DATA = (SLOPE * GRAY) + INTCPT

(4) INTCPT is the intercept value of the linear relationship which will be used to convert image gray levels into the data values output by button A3. The equation is given above.

(5) NEW_CHAN is the number (1 to 14) of the memory channel one wishes to display. The button A2 can be used to list the images currently loaded in the display channels. A new image may then be displayed by using button C2 and specifying its channel number.

(6) IMG_NAME is the name of a disk file containing an image that one wants to drop into the image display refresh memory specified by CHANNEL. This request is initiated by button C2. IMG_NAME cannot be a full-width image, i.e. greater than 512 x 512. Such images must be dropped using the proc WINDOW prior to invoking READ. If the null value "--" is specified, no action will be taken. The extension ".IMG" will be used by default if it is omitted from the file name.

(7) CHANNEL is the channel number (1 to 14) in which to drop the image IMG_NAME. Note that any image contained in CHANNEL will first be deleted. Button A2 may be used to list the images currently loaded in the display channels and to dtermine the empty channels. If the null value "--" is entered for IMG_NAME, no action will be taken and CHANNEL will be ignored.

(8) OUTPUT selects where the output resulting from button A3 and B3 is to be directed. Enter a value of "0", "1" or "2" with the meanings as follow:

OUTPUT=0. The output will be displayed only on the terminal. If the output was previously going to the printer, that output will be spooled out to the printer at this time. If the output was going to a disk file, that file will be closed.

OUTPUT=1. The output will be displayed at the terminal and written to a file for printing. The file will be spooled for printing when the value of OUTPUT is changed or when READ is exited. If the output was previously going to a disk file, that file will be closed at this time.

OUTPUT=2. The output will be displayed on the terminal and written to a disk file which you will be able to display, edit, or print using host commands after exiting READ. When using this option, you must specify FILENAME. If the output was previously going to the printer, it will be spooled out at this time. If the output was going to a disk file whose name is different from FILENAME, that file will be closed. If it was going to a file of the same name, the output will continue to be appended to that file.

(9) FILENAME is the name of a disk file to receive the output for buttons A3 and B3. FILENAME is ignored if OUTPUT=0 or 1 but must be specified if OUTPUT=2. The output will continue to be written to FILENAME until the value of OUTPUT is changed or a new FILENAME is specified at which time FILENAME will be closed. Note that once a file is closed, it cannot be reopened. If FILENAME is the same as that previously used for a file which has been closed or already existed on the disk, a new version of that file will be created. The extension ".DAT" will be used by default if it is omitted from the file name.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Display Geophysical Values | Display Gray Values | Select Image Type | | Exit |
| 2 | List Channels and Images | Change Channel | Drop New Image | | Invoke LATLON |
| 1 | Mark Cursor/Box on Graphics Plane | Change Cursor/Box Size | Use Next Graphics Plane | | Set Output Destination |

A1: The current location of the cursor/box will be marked on the graphics plane currently selected by PLANE when this button is depressed.

A2: This button lists the refresh memories and what image files have been loaded into them, as well as indicating the one currently being displayed.

A3: This button allows the user to output the image values in geophysical units that are inside the cursor box. Other output includes standard deviations (with and without 0 and 255), and the screen coordinates of the box center.

B1: The cursor box size can be incrementally changed using this button. The possible sizes are 1x1, i.e. a crosshair, 3x3, 7x7, 15x15, 31x31 and 63x63.

B2: This button allows the user to change the refresh memory or channel that is currently being displayed. The user is prompted for the parameter NEW_CHAN.

B3: This button allows one to obtain the image values within the box in terms of gray levels (0 to 255).

C1: Depressing this button increments PLANE by one. This new graphiccs plane will then be used for marking the cursor/box location initiated by button A1.

C2: This button allows the user to drop a new image into an IIS refresh memory. The name of the file (IMG_NAME), and the channel number (CHANNEL) are required as input.

C3: The parameter TYPE can be changed with this button.

F1: The output destination can be changed using this button. The user is prompted for where the output should go (OUTPUT) in addition to the terminal, i.e. to a file or to the printer. The disk file name (FILENAME) will also be requested (this is ignored if the output is not going to a file). The output will continue to be routed to this destination unless a change is requested.

F2: This button calls the proc LATLON which allows the user to determine the latitude/longitude values of any location on the image. The button menu for LATLON is dropped and one can follow the normal procedure using this program. See it's documentation for further details. Depressing button F3 exits LATLON and returns the user to READ.

F3: This button exits the proc READ when the READ button menu is being displayed. If the LATLON button menu is being displayed, it returns the user to READ.

**PROGRAM NAME:** REGION
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** For the currently displayed image, this proc defines up to seven blotched regions (one in each blotching plane) based on the user specified latitude/longitude coordinates. Each blotched region is defined by four corner coordinates entered as latitude/longitude pairs in either a clockwise or counter clockwise order. The blotched region is valid (and hence displayed) only if all four corners fall within the input image.

**PARAMETERS:**

(1) R1 locates the first region which will be placed in graphics plane 1. Four pairs of latitude/longitude values corresponding to the region's corner points need to be entered to define the area to be blotched. These corner coordinates can be entered in either a clockwise or counter clockwise order. The latitude value must be entered before the longitude in each pair.
(2) R2 locates the second region and uses plane 2. The input is similar to R1.
(3) R3 locates the third region and uses plane 3. The input is similar to R1.
(4) R4 locates the fourth region and uses plane 4. The input is similar to R1.
(5) R5 locates the fifth region and uses plane 5. The input is similar to R1.
(6) R6 locates the sixth region and uses plane 6. The input is similar to R1.
(7) R7 locates the seventh region and uses plane 7. The input is similar to R1.

IIS BUTTON DEFINITIONS:

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Fill Current Plane | Erase Current Plane | | | Exit |
| 2 | Start Next Plane | | | | |
| 1 | | | | | |

A3: This button enables the user to "fill" the region defined by the currently selected graphics plane.

A2: One can select the next graphics plane on which to work, i.e. to fill with a blotch or to erase a blotch previously generated.

B3: This button can be used to erase a blotch on the currently selected graphics plane. The outline of the region remains; only the filled area inside the boundary is erased.

F3: Depressing this button exits the proc REGION.

**PROGRAM NAME:** <u>REGIST</u>
**DATE:** <u>4/15/91</u>
**MENU:** <u>GEOGRAPHIC</u>

**DESCRIPTION:** REGIST is a proc that allows the user to manipulate the position of as many as two images in the display memory. The program can be used to shift (X and Y) an image relative to another image or graphics overlay. The program is particularly useful for aligning an image with a coastline overlay using the trackball to interactively shift the image. To do this, the graphics overlay must be displayed using BPSAV prior to entering REGIST. The final X and Y shifts in pixel values are output to the screen when the "Terminate Function" button is pressed.

**PARAMETERS:**

(1) CHAN references the refresh memories containing the images to be used. REGIST handles one or two images. If only one image is to be used, enter the same value twice.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Select First Input | Select Second Input | Save Registered Image | Drop a New Image | Terminate Function |
| 2 | Increment Zoom | Exchange Top and Bottom | Upper Left Quadrant Select | Upper Right Quadrant Select | Split or Scroll Toggle |
| 1 | Decrement Zoom | Exchange Left and Right | Lower Left Quadrant Select | Lower Right Quadrant Select | Select All Quadrants |

A3: Displays the first input image.
A2: Magnifies the current image around the screen center location by factors of two, up to a magnification factor of 8. Magnification is accomplished by pixel replication.
A1: Steps backward in magnification by one-half.
B3: Displays the second input image.
B2: Swaps the top half of the image with the bottom half. Works only in the split toggle mode (F2).
B1: Swaps the right half of the image with the left half. Works only in the split toggle mode (F2).
C3: Allows you to save the registered image.

1) NEW_CHAN is the number of the channel to receive the image. If CHANNEL is occupied, you will be given the option to overwrite the resident image.
2) SAVENAME is the name of a disk file to create for saving the currently registered image. If SAVENAME="--", the program will save the image in NEW_CHAN only. The extension ".IMG" will be used by default if it is omitted from the file name.
3) HDR_NAME is the name of a SEAPAK image file from which to copy the header into the image file to create, SAVENAME. If the null value (--) is entered, a zero filled header will be used. The extension ".IMG" will be used by default if it is omitted from the file name.
4) OVERWRIT: If prompted, the channel specified to receive the image already contains an image. Do you want to overwrite the image residing in that channel? If "YES", the resident image will be lost; if "NO" this button function will be canceled and you will be returned to the button menu.

C2: Replaces a portion of the upper left corner of the current image with corresponding portion of the other image. This function works only the in split toggle mode (F2) and must be followed by A3 or B3. The size of the replaced area can be varied using the trackball. Once the desired areas from the two images are displayed together, they can be shifted relative to one another by selecting the scroll mode (F2).

C1: Similar to C2.

D2: Similar to C2.

D3: Drops an image into the refresh memory.

1) INFILE is the name of a disk file containing an image. This image will be dropped into the image display refresh memory. The extension ".IMG" will be used by default if it is omitted from the file name.

D1: Similar to C2.

F3: Resets any shifting of the channels and exits to SEAPAK.

F2: Switches between the split screen and scroll modes. The scroll mode uses the trackball to roam a magnified image. The scroll mode works with buttons A1 and A2 and the split screen mode works with buttons B1, B2, C1, C2, D1, D2 and F1.

F1: Replaces all quadrants of the displayed image when used in conjunction with A3 or B3.

**PROGRAM NAME:** RESCALE
**DATE:** 4/15/91
**MENU:** IMGUTIL

**DESCRIPTION:** RESCALE is a proc which rescales an input image. The image can be linearly rescaled or the existing linear scale can be converted to pigment using the SEAPAK pigment to gray level mapping algorithm. This proc is especially valuable when one has been using various proc's which automatically scale an image for display purposes and desires to have the images scaled alike for visual comparisons. The image which is to be rescaled must have a valid slope and intercept in the header in order to use this proc. To linearly rescale, one must only input the min/max data values and the gray level range one wants to assign them.

**PARAMETERS:**
(1) INFILE is the name of the input image to be rescaled. This file must have valid slope and intercept coefficients stored in the header block.
(2) OUTFILE is the name of the rescaled image. The new slope and intercept coefficients are stored in the header block.
(3) MODE indicates whether one wants to linearly rescale the input image ( enter a value of 1 ) or rescale the image with the SEAPAK pigment equation ( enter a value of 2 ). For either mode, the actual data value for each pixel in the input image file is calculated using the slope and intercept values stored in the input image file header. The slope and intercept values are updated in the output image file.
(4) MIN is the minimum data value to map from. This parameter is used in MODE 1 only.
(5) MAX is the maximum data value to map from. This parameter is used in MODE 1 only.
(6) GMIN is the minimum gray level to which one wants to map. This parameter is used in MODE 1 only.
(7) GMAX is the maximum gray level to which one wants to map. This parameter is used in MODE 1 only.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** RGBDIS
**DATE:** 4/15/91
**MENU:** MOSAIC

**DESCRIPTION:** RGBDIS takes a three-band 512x512 image and drops the red, green and blue bands onto three refresh memories with respective red, green and blue look up tables. Images generated using MOSAIC are displayed by this program.

**PARAMETERS:**
(1) INFILE is the name of the disk file one wants to display. This file should contain three band, 512x512x8 bit image data. The sequence of the three bands is red followed by green and green followed by blue. The input file is most likely generated by the program MOSAIC. The extension ".RGB" will be assumed as the default if it is omitted in the input specification.
(2) CHANS is the refresh memory numbers for the display of the red, green and blue bands in that order.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** RING
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This program allows the user to mask out areas of sensor "ringing" on any CZCS level-2 product images. This ringing effect occurs when the sensor scans from bright areas, such as clouds, ice, or sand, onto darker (ocean) areas (Mueller, 1988). Over the bright areas, the radiometer saturates and requires a certain amount of time to recover after scanning away from such areas. During this recovery period, abnormally high counts will be recorded, often in a periodic fashion (thus "ringing"). The CZCS level-1 band 4 and band 5 images are needed by the program to determine the saturated and the land or cloud pixels. The program checks each pixel from west to east (the scanning direction) to see if the pixel is a land or cloud pixel (a level-1 band 5 gray level greater than or equal to LANCLD) and if it is saturated (a level-1 band 4 gray level greater than or equal to SATGRAY). If so, and the gray-level difference between that pixel and the adjacent east pixel in the level-1 band 4 is greater than DELTA, then DISTANCE pixels after the test pixel will be masked out as being ringing affected. Note that all input images must be unmapped.

If the null value ("--") is entered for CHLFILE or SAVENAME, the user will have to use the button menu (display mode) to run this program. In that case, the rest of the main input parameters will be ignored.

**PARAMETERS:**

(1) CHLFILE is the name of the unmapped, CZCS level-2 image file. The extension ".IMG" will be used by default if it is omitted from the file name. If the null value ("--") is entered for CHLFILE or SAVENAME, the user will have to use the button menu (display mode) to run this program. In that case, the rest of the main input parameters will be ignored.

(2) SAVENAME is the name of a disk file to create for the ringing mask image. It will have the header record from CHLFILE. The extension ".IMG" will be used by default if it is omitted from the file name. If the null value ("--") is entered for CHLFILE or SAVENAME, the user will have to use the button menu (display mode) to run this program. In that case, the rest of the main input parameters will be ignored.

(3) INFILE is the CZCS unmapped level-1 band 4 (670 nm) image file which was used with the other level-1 bands to generate the level-2 image CHLFILE. A pixel will be considered saturated if its gray level in this file is greater than or equal to SATGRAY. If a pixel is a land or cloud pixel (see LCFILE), is saturated, and the difference in gray levels between it and the adjacent east pixel in INFILE is greater than or equal to DELTA, then DISTANCE pixels after this pixel will be masked out (assigned the value of MASKGRAY) as being ringing affected pixels in SAVNAME.

(4) LCFILE is the CZCS unmapped level-1 band 5 (750 nm) image file which was used with the other level-1 bands to generate the level-2 image CHLFILE. A pixel will be considered a land or cloud pixel if its gray level in LCFILE is greater than or equal to LANCLD. (See INFILE for more information.)
(5) LANCLD is the gray level for the land/cloud pixel test. A pixel will be considered as a land or cloud pixel if its gray level in LCFILE is greater than or equal to LANCLD.
(6) SATGRAY is the gray level for the saturated pixel test. A pixel will be considered as saturated if its gray level in INFILE is greater than or equal to SATGRAY.
(7) DELTA is used to test for the ringing effect. If a pixel is a land or cloud pixel (see LCFILE) and is saturated (see INFILE), then if the difference in gray levels between it and the adjacent east pixel in INFILE is greater than or equal to DELTA, DISTANCE pixels after this pixel will be masked out (assigned the value of MASKGRAY) as being ringing affected pixels in SAVNAME.
(8) DISTANCE is the number of pixels to be masked out in SAVNAME as being affected (unreliable) east of the pixel where the onset of a ringing effect is detected (see DELTA).
(9) MASKGRAY is the gray level to be assigned to the DISTANCE pixels in SAVNAME following the onset of each ringing effect.

**IIS BUTTON DEFINITIONS**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Read | Fix line | | | Exit |
| 2 | | | | | |
| 1 | List channels and images | Display another channel | Save current image | Drop a new image | Generate ringing masked image |

A1: Displays the names of any images currently loaded in the refresh memories and the number of the channel currently displayed.
A3: Invokes the proc READ. Pressing button F3 ("Exit") on that menu will return you to this menu.
B1: Displays a specified channel.
1) NEW_CHAN is the number (1 to 14) of the new channel to display.

B3: Invokes the proc FIXLIN. Pressing button F3 ("Exit") on that menu will return you to this menu.

C1: Saves the currently displayed image to a disk file.

1) SAVENAME is the name of a disk file to create for saving the currently displayed image. The extension ".IMG" will be used by default if it is omitted from the file name.
2) HDR_NAME is the name of a SEAPAK image file from which to copy the header into the image file to create, SAVENAME. If the null value (--) is entered, a zero filled header will be used. The extension ".IMG" will be used by default if it is omitted from the file name.

D1: Drops an image into a specified channel.

1) DROPNAME is the name of a disk file containing an image. This image will be dropped into the image display refresh memory specified by CHANNEL. DROPNAME cannot be a full-width image. Such images must be dropped using the proc WINDOW prior to invoking IMGEDIT. The extension ".IMG" will be used by default if it is omitted from the file name.
2) CHANNEL is the number (1 to 14) of the channel in which to drop the file specified in DROPNAME. If CHANNEL is occupied, you will be given the option to overwrite the resident image.
3) OVERWRIT: If prompted, the channel specified to receive the image already contains an image. Do you want to overwrite the image residing in that channel? If "YES", the resident image will be lost; if "NO" this button function will be canceled and you will be returned to the button menu.

F1: Generates the image with the "ringing" pixels masked out. You will be prompted for INFILE, LCFILE, LANCLD, SATGRAY, DELTA, DISTANCE, and MASKGRAY, described above, as well as OUTCHAN, the channel number of the refresh memory to receive the masked image.

F3: Exits this proc.

**PROGRAM NAME:** RLINE
**DATE:** 4/15/91
**MENU:** EXTRACT

**DESCRIPTION:** RLINE allows one to read the data values of an image along defined vectors. The user defines a vector by first moving the cursor to the starting point of the vector and pressing button A1 and then selecting the ending point with the cursor and pressing the same button. A vector may then be drawn between the endpoints using button C2. A vector connected to this one may also be created by again defining a new vertex with A1 and then using C2 to draw it (this joins the endpoint of the previous vector to the point just defined). The values of the joined vectors may be written to the screen, the printer or a disk file. Once the user is finished processing, he may start a new set of joined vectors on this image without erasing the first or change images. If a vector is required that is not connected to the previous one, simply press F2 and continue as before. The capability also exists to erase the last vector from the display, or change its endpoints. The user may press EXIT (button F3) at any time to leave the program.

**PARAMETERS:**

(1) VPLANE specifies the graphics bit plane in which the vectors or lines will be drawn. An integer between 1 and 7 should be entered. If INT or GRPINTL was used for initialization, the planes are colored as described above but can be modified using BPCOLOR.

(2) PPLANE specifies the graphics bit plane in which the plots will be drawn. An integer between 1 and 7 should be entered. If INT or GRPINTL was used for initialization, the planes are colored as follows:

Plane 1 = pink
Plane 2 = red
Plane 3 = green
Plane 4 = yellow
Plane 5 = orange
Plane 6 = cyan
Plane 7 = sand

BPCOLOR can be used to change the colors of the planes.

(3) OPTION specifies the input image data type. An integer with a value of 1 through 5 should be entered. The values are:

1 specifies a CZCS chlorophyll channel,
2 specifies a AVHRR sea surface temperature channel (in degrees Celsius) ,
3 specifies a CZCS sea surface temperature channel (in degrees Celsius),
4 specifies geophysical values derived from the slope and intercept in the image header,
5 specifies the use of gray level values.

(4) BLANK tells the computer whether or not to blank the selected bit plane before running the program. A 'YES' indicates that

the bit plane is to be blanked, a response of 'NO' indicates that it will not be.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Drop New Scene/ Change Refresh Memory | Change Data Type | Change Graphics Plane | Plot Vector Data | Exit |
| 2 | Define New Vertex | Erase Last Vertex | Draw Vector | Erase Vector | Start New Vector |
| 1 | TV To/From X,Y | TV To/From Lat/Lon | On/Off /Erase Graphics Plane | | Output Values To CRT, File, Printer |

A1: This button allows the user to determine the (x,y) coordinates of the current cursor location or to move the cursor to a specified (x,y). The user is prompted for three additional parameters:

1) MODE defines whether the user wants to move the cursor to a given (x,y), MODE = 1, or list the (x,y) of the current cursor location, MODE = 2.
2) X is the pixel value (from 1-512) that the cursor should move to.
3) Y is the line value (from 1-512) that the cursor should move to.

A2: This button defines a new vertex for the vector and marks it with the plane specified by VPLANE.

A3: This button allows the user to display a new image from within the program, either by changing the refresh memory or dropping a new scene. The user is immediately prompted by the parameter ACTION to determine the action to be performed. One should enter a 'C' to change the refresh memory number or a 'D' to drop a new scene. When a 'C' is entered, the proc SELECT is called and it's parameters are requested (see the documentation of that proc for more information). When a 'D' is entered, the proc IMAGE is called and it's parameters are requested (see the documentation of that proc for more information).

B1: This button allows the user to determine the latitude/ longitude of the current cursor location or to move the cursor to a specified latitude/longitude. The user is prompted for three additional parameters:

1) MODE defines whether the user wants to move the cursor to a given latitude/longitude, MODE = 1, or list the latitude/longitude of the current cursor location, MODE = 2.
2) LAT is the latitude value (from -90 to 90) that the cursor should move to.
3) LON is the Longitude value (from 0 to 360, increasing eastward) that the cursor should move to.

B2: This button allows the user to erase vertices beginning with the most recent one. If the most recent one is erased, then the next most recent can be erased, etc.

B3: This button enables the user to change the parameter OPTION. See above for the various values that can be input.

C1: This button allows enabling, disabling or clearing single or multiple graphics planes. The user is prompted for two parameters, PLANES and ONOFF. PLANES is a list of up to 7 graphics planes to be turned on, off or erased. ONOFF specifies the action to be performed for each plane. One should enter a "0" to turn the plane off (disable), a "1" to turn it on (enable), or a "2" to erase (clear) the plane. The same number of values for PLANES and ONOFF must be entered.

C2: This button causes a vector to be drawn between the last two vertices which have been defined (A2 is used to define the points).

C3: This button allows the user to change the default graphics plane for vectors or plots. The following two parameters prompt the user:
1) TYPE specifies whether it is the vector or plot graphics plane. One should enter a V or P respectively.
2) PLANE is the graphics plane one wants to assign for TYPE. The value must be between 1 and 7.

D2: This button causes the last vector to be erased.

D3: This button enables the user to plot the data along the line that has been drawn to the IIS and/or the HP 7550A plotter. Parameters that one will be prompted to input are:
1) PPLANE is the color or graphics plane in which the plot will be drawn.
2) RANGE consists of two values. The first one entered corresponds to the lower bound and the second to the upper bound of the graph to be displayed. The values entered must bear the same units as the current image (i.e. temperature, pigment concentration, radiance units or gray level).
3) DEVICE defines the destination for the plot output. Enter "II" to plot to the IIS monitor or "HP" to generate a hardcopy on the HP 7550 plotter. Specifying both will produce output on each device.
4) XUNITS sets the units for the x-axis. An L indicates a choice along the x-axis of lags (pixels along the vector), while a D is a choice for distance in kilometers.

F1: This button allows one to direct the data output to any of three places. The data along the line can be output to the terminal, the printer or the disk as an ASCII file by setting the prompt parameter (DEST) as T, P or F respectively. The mean, standard deviation and minimum/maximum values are also output along with the data points. If 'F' is entered, the user will be prompted for FILENAME to specify the name of the disk file to create for the output.

F2: This button enables the user to start new vectors or lines that are not connected to the others. This allows the user to put several independent tracks on the display at the same time.

F3: This button terminates the proc.

**PROGRAM NAME:** SCATT
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This procedure will generate a scatterplot for the corresponding areas of two images resident in the display's refresh memories. The output may be directed to a graphics plane or to an image channel. If a channel is used, the intensity (gray level) of the scattergram's points will be proportional to the number of points with those values, i.e. the count. A scale factor may be used to control those intensities. The inside or outside of a blotch, or the full images, may be specified as the areas of interest. Either image may be of pigment concentrations or units linearly proportional to the gray scale. Ranges of values in corresponding units may be used to restrict the pixels to consider. Histograms may also be requested and will appear at the top and to the right of the scattergram. The procedure allows the option for labels on the axes as well as an annotation line below the scattergram. The scatterplot may also be overlayed with a grid if desired.

**PARAMETERS:**

(1) CHN1 is the channel number for one of the two input images. An integer between 1 and 14 should be entered. The X axis of the scattergram will be used for the image in CHN1 and the Y axis for the CHN2 image. Note that CHN1 and CHN2 cannot have the same value and cannot be channel pairs (e.g., 1 and 8, 2 and 9, etc.).

(2) CHN2 is the channel number of the second image and will be the Y axis of the scattergram. Again, an integer between 1 and 14 should be entered with the qualification as mentioned above, i.e. CHN1 and CHN2 cannot have the same value or be channel pairs.

(3) MODE1 defines whether the image in CHN1 is scaled linearly or is in pigment concentration. A value of "1" (the default value) should be entered if the pixel values of the CHN1 image represent data (such as temperature) that are linearly related to gray levels. A value of "2" should be entered if they represent pigment concentrations (mg/m3).

(4) MODE2 is similar to MODE1 except that it defines whether the image in CHN2 is scaled linearly or is in pigment concentration.

(5) FACT1 is a non-negative scaling factor which is used only if MODE1=1, i.e. the data-to-gray scale mapping function is linear for the CHN1 image. It is ignored when MODE1=2. If FACT1 is positive, it will represent the factor by which to divide the gray values of CHN1 pixels in order to convert them into actual data values. If zero is entered, the slope and intercept for this mapping function will be obtained from the header of the disk file for the CHN1 image. In order to retain the gray values, a "1" (the default value) should be

entered ; for sea surface temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 170. Note that the use of different linear mapping functions does not alter the appearance of the scattergram or histograms in any way other than ensuring that the values labelling the axes reflect those of the image data.

(6) FACT2 is the linear, data-to-gray scale mapping function for CHN2. Similar comments apply here as are found for FACT1.

(7) RANGE1 defines the range of CHN1 pixel values to use for the determination of the scattergram and, if HIST=1 or 3, the CHN1 histogram. Two values should be entered for this parameter. These values should conform to the units of the CHN1 image (i.e. pigment concentration or units linearly proportional to gray levels) as specified by MODE1 and FACT1. Pixel values less than the smaller RANGE1 value and those greater than the larger RANGE1 value will be excluded from the plots. Therefore this range will determine the limits of the X axis and CHN1 histogram. For example, to exclude land and cloud pixels for a level 2 CZCS image, the RANGE1 values should be 1.0 and 254.0 (the default values) for gray levels (MODE1=1 and FACT1=1) or 0.0425 and 39.0 for pigment concentrations (MODE1=2).

(8) RANGE2 defines the range for CHN2 values in data units. The comments above for RANGE1 are also applicable here except now they apply to CHN2 and hence the Y axis.

(9) BPLANE is the number of the graphics plane containing the blotch area of interest. An integer in the range -7 to 7 should be entered. If the number is positive, only the pixels within the blotch will be considered; if the number is negative, only the pixels outside the blotch will be considered. If "0" is entered, the entire image area (512 x 512) will be used. This blotch, if used, must already be resident in the graphics channel of the display unit since the option to create it within the program does not exist. You may use the proc BPSAV to restore a previously generated blotch onto a specific plane.

(10) OUTCHN is the channel number to use for the scatterplot and/or histogram output. If "0" (the default value) is entered, the graphics plane specified by GPLANE will be used for the output. If an image channel number (1-14) is entered, the output will go there. In this case the intensity of the scattergram points may be used to indicate the pixel count for each point (more is said on this in the description of SCALE). OUTCHN cannot be one of the input image channels.

(11) GPLANE is the number of the graphics plane on which to display the output when OUTCHN=0. Any plane from 1 to 7 may be used except the one on which the blotch (if being used) is drawn. If OUTCHN is an image channel, GPLANE is ignored.

(12) SCALE is an intensity scale factor and is used when the output is directed to an image channel (i.e. OUTCHN is between 1 and 14). In this situation, the intensities of the plotted scattergram points reflect the relative number of pixels (the

count) represented by each point. Points with counts between the minimum and maximum values are given gray levels between 1 and 255 according to a linear scale where the mean is assigned to gray level 128 (half intensity). SCALE is used to multiply each point's count before applying the scale to assign gray levels for plotting. If OUTCHN=0, SCALE is ignored. Note that, when HIST=3, the two histogram lines corresponding to each scattergram point may also be used as an indication of the count.

(13) HIST is a flag indicating whether or not histograms should also be generated. If HIST=0, no histogram is displayed (the scattergram is of course still generated). If HIST=1, only the CHN1 histogram is displayed; if HIST=2, only the CHN2 histogram is displayed; if HIST=3 (the default value), histograms of both CHN1 and CHN2 are generated along with the scattergram. The CHN1 histogram is displayed above the scattergram (parallel to the X axis) and the CHN2 histogram is displayed to the right of the scattergram (parallel to the Y axis). The values labelling each scattergram axis also apply to the corresponding histogram. The pixels used in the histogram generation are the same as those used in the scattergram and hence are also determined by RANGE1 and BPLANE for CHN1 (X axis) and by RANGE2 and BPLANE for CHN2 (Y axis). Note that each plotted scattergram point forms the intersection of two lines, one from each histogram, the sum of whose lengths indicate the relative number of pixels from the two images represented by that point.

(14) GRID is a flag indicating whether or not the scatterplot should be overlayed with a grid. If GRID="YES" (the default value), the scatterplot will be displayed with a quartile grid. If GRID="NO", only the axes (drawn as a box) will be used.

(15) ANNOT is the annotation text that will be used for the caption on the bottom of the scatterplot. A maximum of 70 characters may be entered. The default value of one blank indicates that no annotation is to be displayed.

(16) XLABEL is the text which will be used to label the X axis of the scatterplot. Up to 35 characters may be entered. The default value of one blank indicates that there will be no label for this axis.

(17) YLABEL is the text which will be used to label the Y axis of the scatterplot. As with the X axis, up to 35 characters may be entered, with the default value of one blank indicating that there will be no label for this axis.

**IIS BUTTON DEFINITIONS:**

No buttons are used in this program.

**PROGRAM NAME:** SCREEN
**DATE:** 4/15/91
**MENU:** ATMOS

**DESCRIPTION:** This proc will display the image generated by the proc CLRWAT (non-"box" mode) whose gray levels represent the various criteria used in screening the image to identify "clear water" pixels. A color code is applied to clearly indicate the various types of pixels:

| | |
|---|---|
| BLACK | Land, cloud, or haze pixels. |
| PURPLE | Pixels at which the sun or scanner zenith angle is too high. |
| BROWN | Pixels whose aerosol radiances are outside valid range. |
| BLUE | Pixels for which the channel 2 and 3 normalized radiances are outside desired ranges. |
| YELLOW | Pixels whose pigment concentrations are too large. |
| GREEN | Pixels for which the epsilons are outside desired ranges. |
| ORANGE | Pixels for which the epsilons are non-monotonic. |
| WHITE | Clear-water pixels. |

The sequence of the listed colors represents the order in which the criteria are applied and the pixels eliminated. For example, a brown pixel would be designated as such if and only if the following results were obtained for these tests:

| | | | | |
|---|---|---|---|---|
| 1. | Land, cloud, or haze? | No. | | |
| 2. | Sun or scanner azimuth too high? | No. | | |
| 3. | Aerosol pixel? | Yes. | => | No further tests. |

More detailed information about the actual criteria is given in the help text of CLRWAT.

**PARAMETERS:**
(1) FILENAME is the name of the file, generated by the non-"box" (automated) mode of CLRWAT, containing the color coding for the clear-water pixel screening process. Note that the extension should be explicitly typed in since ".IMG" will be used by default if it is omitted.
(2) CHAN is the memory channel number in which to display FILENAME.

**IIS BUTTON DEFINITIONS:**
No button functions are used.

**PROGRAM NAME:** SELECT
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** Program SELECT displays the user-specified refresh memory(ies) of the IIS. Several refresh memories can be displayed at one time.

**PARAMETERS:**

(1) CHANNEL defines the IIS image channel(s) to be displayed on the color monitor. The parameter accepts up to 14 values, each of which corresponds to the channel desired (1=channel 1, 2=channel 2, etc.). The acceptable values are:

```
-1  --  select all memories
 1  --  select memory 1
 2  --  select memory 2
     .
     .
     .
14  --  select memory 14
```

EX: CHANNEL = 1 selects image channel 1
CHANNEL = (4,1,2,3) selects image channels 1,2,3 and 4
CHANNEL = (2,1) selects image channels 1 and 2

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** SOAGPCDF
**DATE:** 4/15/91
**MENU:** CDFIN

**DESCRIPTION:** This program converts a disk file containing NODC's Southern Ocean Atlas Grid Point Data (SOAGPD) into a common data format (CDF).

**PARAMETERS:**

(1) INFILE is the name of the disk file containing the SOAGPD in the format of NODC's tape used to distribute it. The file must be as that read from the NODC tape of the data set: 9,180 to 9,231 records (the last 51 records are repeats of the first 51 points along 0 longitude and are ignored) and 1,562 bytes/record. The extension ".DAT" will be used by default if it is omitted from the file name.

(2) OUTFILE is the name to be given to the CDF version of the SOAGPD.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** SOCEAN
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays illustrating the results of a study done in the southern hemisphere ocean, using SEAPAK programs.

The examples are, in sequence:

1. Navy bathymetry image for southern ocean - cylindrical equidistant projection.
2. 1979-1986 NOAA/Climate Analysis Center mean sea surface temperature.
3. Density (sigma-T) at 100 meters, from gridded NODC Southern Ocean atlas.
4. Density (sigma-T) at 250 meters, from gridded NODC Southern Ocean atlas.
5. Density (sigma-T) at 500 meters, from gridded NODC Southern Ocean atlas.
6. Loop of examples 3-5.
7. 308 FGGE drifter tracks on Navy bathymetry image (polar stereographic projection).
8. FGGE drifter movement computed from 5x5 degree binning.
9. Eddy kinetic energy computed from 1x1 degree FGGE drifter binning, smoothed with an 11x11 point filter.
10. Eddy kinetic energy computed from Geosat-derived altimetry, courtesy of Dr. Chester Koblinsky, NASA/GSFC.
11. Loop of 9 and 10.
12. 1978-1986 mean CZCS pigment image.
13. Plate 1 summarizing these results.
14. Plate 2 summarizing these results.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** SPBATCH
**DATE:** 4/15/91
**MENU:** GENUTIL

**DESCRIPTION:** This proc allows you to submit certain other SEAPAK procs to the batch queue using wild cards in the INFILE file specification. SPBATCH will search the specified directory for the highest version of all files meeting the specification. (The highest versions are used unless a wild card or version number specifies otherwise.) A batch job is submitted invoking the SEAPAK proc PROCNAME once for each file found meeting the INFILE specification. Each file name found is used for the value of PROCNAME's input and output file parameters. Values for the other parameters of PROCNAME are obtained from PARNAME. The time at which to execute the submitted batch job may be controlled using the TIME parameter.

The batch job submitted will have a 15-character name shown by the command SHOW-BATCH. The name uniquely identifies this SPBATCH run. It is composed of the date (the first 5 digits, YMMDD), the time (the next 5 digits as seconds of the day), and a 5-character code identifying the session. Output from PROCNAME that would normally be displayed on the terminal if PROCNAME were being run interactively (and other information) is sent to two files having the same name as the batch job with the extensions "LOG" and "OUT".

**PARAMETERS:**

(1) PROCNAME is any one of the following SEAPAK proc names to run in batch: DK2IMG, DSPIMG, EPSILON, L2DUAL, L2GAC, L2MULT, MAPIMG, PSTIMG, ZONE.

(2) INFILE is a VAX/VMS file name specification. INFILE will be used to obtain the input and output file names for the proc specified by PROCNAME. Wild cards are permitted as described below. SPBATCH will submit a batch job invoking PROCNAME once for each file found that matches the specification. Remember that any logical names defined by you and used as part of INFILE must be defined by your login for them to be valid during a batch run.

The name of each file that is found to match the INFILE specification will be used as the value of PROCNAME's INFILE input parameter. If PROCNAME is DSPIMG or PSTIMG, INFILE will be used as the input parameter DSP_IMG and it must be in DSP's filename/subimage/band syntax. Default portions of the file name extension (device, directory, extension) are supplied according to the rules specified for PROCNAME's input file name parameter (INFILE or DSP_IMG).

File name specifications may include "%" and "*" as wild cards in the filename, the symbol "..." to indicate all daughter directories, and the symbol "-" to indicate a parent directory. However, if PROCNAME is a level 2 proc (e.g., EPSILON, L2DUAL), the last character of INFILE prior to any extension cannot be wild. This restriction is necessary so

that you do not inadvertently run the level 2 PROCNAME for each band of the same image, which might be named, for example, BAND1.IMG, BAND2.IMG, etc. If a wild card or a version number does not specified otherwise, only the highest version of each file name found will be used.

INFILE will also be used to formulate the names of output files required by the proc specified by PROCNAME. See the help text for OUTDIR for more information.

(3) OUTDIR is the directory specification to use for the output files generated by the proc specified for PROCNAME. The directory specification includes any node and device specification. If the null value "--" (default) is entered, the directory specification of INFILE, if any, will be used. Remember that any logical names defined by you and used as part of OUTDIR must be defined by your login for them to be valid during a batch run.

The actual name(s) to be used for the output file name parameter(s) of the PROCNAME proc will be comprised of OUTDIR and a file name based on that of each file found to match the INFILE specification. The output file name extensions will be those supplied by default by the specified PROCNAME.

In a file name specification, such as "DUB1:[SMITH.DATA]-NORTH.NEW", we refer in the following discussion to the "NORTH" portion of the name by the single word "filename."

The rules for composing the output filename(s) corresponding to each input file found to match the INFILE specification depend on the proc specified for PROCNAME:

- DK2IMG: The input filename is used. DK2IMG adds an index number to the filename to indicate the CZCS band.
- DSPIMG, PSTIMG: "D" is added to the input filename.
- MAPIMG: "M" is added to the input filename.
- ZONE: "Z1" and "Z2" are added to the filename for its two output file parameters, OUTFIL1 and OUTFIL2, respectively.
- EPSILON, L2DUAL, L2GAC, L2MULT: The last character of the input filename is removed. These level 2 procs will add "L2x" to the filename, where "x" is a one digit index of the level 2 output images.

(4) TIME specifies the time at which to submit the batch jobs of PROCNAME. If the null value "--" (default) is entered or the specified time has passed, the jobs are submitted immediately. The syntax must be that of DCL absolute time (AT) or an offset time from the present (OT) specification. The basic form for AT is "dd-mmm-yyyy:hh:mm:ss.cc" where the date, time, or both may be specified. The date or time may be truncated on the right; however, the date field, if specified, must contain at least one hyphen. Any subfields may be omitted as long as the punctuation is entered. Subfields from the current date serve as date defaults and zero is used as the time subfield defaults. The following keywords may also be used for AT: "TODAY" for 00:00:00.0 o'clock today, "TOMORROW" for 24 hours

after 00:00:00.0 o'clock today, and "YESTERDAY" for 24 hours before 00:00:00.0 o'clock today. Examples of AT values are:

| | | |
|---|---|---|
| 15-APR-1985:12 | ==> | noon, April 15, 1985 |
| 15-apr | ==> | midnight, beginning of April 15, this year |
| 15 | ==> | 3 PM (15:00), today |
| 15- | ==> | midnight, 15th day, this month, this year |
| 18:30 | ==> | 6:30 PM, today |
| 15--::30 | ==> | 15th day, this month, 00:30 o'clock |
| 00:00:00.2 | ==> | 2 hundredths (not tenths) of a second |

The basic form for OT is an AT value, followed by a plus or minus sign, followed by a delta time of the form "dddd-hh:mm:ss.cc". The entire value signifies an offset from the specified AT. The AT portion may be omitted in order to default to the current date and time. If the AT is omitted, the sign must be included. Whenever a plus sign is used, the entire value must be enclosed within double quotes. The hyphen must be included to indicate days of delta time; other syntax rules for the delta portion are similar to those of the AT portion. Examples of OT values are:

| | | |
|---|---|---|
| "+5" | ==> | 5 hours from now |
| "+5-" | ==> | 5 days from now |
| "+:5" | ==> | 5 minutes from now |
| "15-Apr:+:5" | ==> | April 15, 12:05 AM, this year |
| 15-apr:-00:10 | ==> | April 14, 11:50 PM, this year |
| "tomorrow+1-" | ==> | tomorrow plus one day |

(To enter double quotes at the start or end of a TAE string parameter such as TIME, enter three consecutive double quotes. For example, enter """+5""" and ""+5"" will appear on the menu screen, indicating that the inside set of double quotes are part of the string value.)

(5) PARNAME is the name of the parameter file from which to obtain the values for all of PROCNAME's input parameters except INFILE (or DSP_IMG) and parameters for output file names. A disk and directory path may be explicitly specified with the name; otherwise, the current disk or directory is assumed. The default file name extension is ".PAR". If the null value is entered (default), the parameter file is assumed to be in the current directory and to have the same name as PROCNAME with the extension ".PAR"; this is the name used by default by the TAE SAVE command.

You can create a parameter file by invoking the proc PROCNAME in the tutor mode, entering the desired values for each menu item, using the SAVE command, then EXITing so as not to actually execute PROCNAME. The parameter entered for the SAVE command is used for the parameter file name; if no name is entered, a default name is used as described above.

(6) DEVICE is the name of a device which contains INFILE and which must be mounted. The device will be mounted for reading only and will be dismounted after program execution but before the

batch job is submitted. It will be mounted and dismounted again by the batch job when it executes. For example, "LDB0" or "LDB1" may be entered to mount the optical disk drives on the DIATOM node of the Oceans Computing Facility's local area VAX cluster.

**IIS BUTTON DEFINITIONS:**
No buttons are required for this proc.

**PROGRAM NAME:** SR1988
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays showing ancillary data fields available within SEAPAK. This demo was run at the summer 1988 site review.
The examples are, in sequence:

1. Global bathymetry overview showing capability to contour gray shades and blotch between the contours.
2. Winter 1979 mean pigment for Atlantic ocean.
3. Spring 1979 mean pigment for Atlantic ocean.
4. Summer 1979 mean pigment for Atlantic ocean.
5. Fall 1979 mean pigment for Atlantic ocean.
6. Loop of images 2-5.
7. Winter 1979 NOAA/Climate Analysis Center sea surface temperature for Atlantic ocean.
8. Spring 1979 NOAA/Climate Analysis Center sea surface temperature for Atlantic ocean.
9. Summer 1979 NOAA/Climate Analysis Center sea surface temperature for Atlantic ocean.
10. Fall 1979 NOAA/Climate Analysis Center sea surface temperature for Atlantic ocean.
11. Loop of images 7-10.
12. Winter 1979 Ekman upwelling derived from First GARP Global Experiment (FGGE) winds for Atlantic ocean.
13. Spring 1979 Ekman upwelling derived from First GARP Global Experiment (FGGE) winds for Atlantic ocean.
14. Summer 1979 Ekman upwelling derived from First GARP Global Experiment (FGGE) winds for Atlantic ocean.
15. Fall 1979 Ekman upwelling derived from First GARP Global Experiment (FGGE) winds for Atlantic ocean.
16. Loop of images 12-15.
17. Winter 1979 mean FGGE streamlines for Atlantic ocean.
18. Spring 1979 mean FGGE streamlines for Atlantic ocean.
19. Summer 1979 mean FGGE streamlines for Atlantic ocean.
20. Fall 1979 mean FGGE streamlines for Atlantic ocean.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Buttons are defined in the programs called, in particular use F3 to exit the looping.

**PROGRAM NAME:** SR1989
**DATE:** 4/15/91
**MENU:** PRODDEMO

**DESCRIPTION:** This program displays on the IIS model 75 a group of images and the associated graphic overlays illustrating examples from CZCS and ancillary datasets processed by SEAPAK. This demo was shown at the summer 1989 site review.

The examples are, in sequence:

I. Demonstration of capabilities handling Common Data Format (CDF) files received from the National Space Science Data Center (NSSDC) NASA Climate Data System (NCDS)

   A. Examples generated from raw CDF fields
      1. Mixed layer depth, North Atlantic, March mean.
      2. Latent heat flux, North Atlantic December mean.
      3. Net radiation budget, North Atlantic March mean.

   B. Examples generated from oceanographic fields derived from CDF
      1. Ekman upwelling, North Atlantic, February 1979.
      2. Energy dissipation (surface stress to 1.5 power), North Atlantic, February 1979.

   C. Examples of images with wind field overlays
      1. Winter 1979 NOAA/Climate Analysis Center (CAC) North Atlantic mean sea surface temperature and First GARP Global Experiment (FGGE) 1000 millibar streamlines.
      2. Spring 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar stream-lines.
      3. Summer 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar stream-lines.
      4. Fall 1979 NOAA/CAC North Atlantic mean sea surface temperature and FGGE 1000 millibar streamlines.
      5. Loop of examples 1-4 from this section.

   D. Time series capabilities using CDF
      1. Time series of several fields for the week of the President's Day snowstorm, 1979.

II. Demonstration of statistics on gridded imagery

   A. Computation of latitude-weighted mean for open ocean blotch on North Atlantic pigment image (program GRDMEAN will be entered, and button F1 should be pressed to compute the mean).

III. Demonstration of hydrographic data capabilities

A. NODC hydrographic stations, North Atlantic, April 1979.
B. Charleston gyre pigment concentrations, October 28, 1979.
C. Skidaway Institute of Oceanography temperature profiles created with GEMPAK.
D. NODC temperature, salinity, sigma-T and sound speed at ocean surface created with GEMPAK.

IV. Demonstration of gridding and projection capabilities

A. Northern hemisphere Navy bathymetry (1000 and 4000 m. contours), polar stereographic projection.

**PARAMETERS:**
There are no parameters.

**IIS BUTTON DEFINITIONS:**
Buttons are defined in the programs called.

**PROGRAM NAME:** <u>STATDIS</u>
**DATE:** <u>4/15/91</u>
**MENU:** <u>MATH</u>

**DESCRIPTION:** This proc will generate images from real-numbered SEAPAK data files (e.g., those output by the procs DERIV, ADDF, LOGF, etc.) and display them on specified IIS refresh memories. The input files must have all been produced using the same blotch currently residing on the graphics plane designated by the parameter BPLANE, unless no blotch was initially used since full images only were being considered. A button menu will then be presented which allows the user to save these input "data" files as image files. The buttons available vary depending on whether the input data files are linear (MODE=1) or pigment (MODE=2). For linear files, the buttons functions are designed to help the user obtain an optimum gray scale, i.e. a scale which shows the most structure for the areas or features of interest. To this end, some buttons will allow one to examine the minimum/maximum values or generate image histograms so that one may choose more appropriate min/max values with which to rescale each image. Pigment images may not be rescaled. Thus, the user has the freedom to roam the refresh memories where images have been generated in order to determine an optimum scaling if a common scaling for any/all of them is desired. The user may also load previously generated images into the refresh memories if the parent data files still exist and were generated using the same blotch currently residing on the BPLANE graphics plane of the display (unless BPLANE=0 in which case the data files represent full images). Finally, when a user depresses an IIS button and is prompted for parameters, if a null value "--" is entered for one of the values, no action will be taken and the button options will be reactivated. This enables the user to return to the button menu if the wrong button is inadvertently depressed.

**PARAMETERS:**

(1) IN_FILES are the names of real-numbered data files from which to generate images. All IN_FILES must have been generated by a SEAPAK proc (e.g., EOF, DERIV, ADDF, etc.) using the same blotch currently residing in the graphics plane BPLANE or, if BPLANE=0, for a full image. An image corresponding to each file will be generated and displayed in the channel that is entered in the corresponding parameter CHAN. The extension ".DAT" will be used by default if it is omitted from the file name.

(2) CHAN are the refresh memories into which the corresponding IN_FILES will be generated and displayed. Thus, the image of the first IN_FILES file specified will be displayed in the first channel specified, etc. Any integer values in the range 1 through 14 are valid. The number of channels entered must, of course, match the number of IN_FILES, as well as MODE's, and INVAL's.

(3) MODE indicates whether the corresponding IN_FILES is a linear or a pigment file. For each IN_FILES data file, the user should enter a "2" if the data file values are in pigment concentration units (mg/m3), or a "1" for linear. The number of MODE's entered must match the number of IN_FILES, CHAN's, and INVAL's. MODE=1 indicates that a linear scale is used to generate gray level values for the image from the data values. The image may be rescaled by modifying the minimum or the maximum of the data using the IIS button C2. MODE=2 indicates that a pigment scale is used to generate the image. When a pigment image is displayed, button functions related to the rescaling of an image are removed from the button menu and are disabled since such images may not be rescaled.

(4) INVAL are the values in data units that are assigned to the pixels that were flagged as "invalid" in the procs which generated the input data files. This would normally have occurred when pixel values input to that proc were outside a specified range. STATDIS will then assign such pixels the corresponding INVAL value before converting them to gray levels in each image. Thus, the image of the first IN_FILES file specified will use the first INVAL value, etc. The number of INVALs entered must match the number of IN_FILES, CHAN's, and MODE's. By using a very small number (such as -1.0E38) you can ensure that the invalid pixels are black (gray level 0) in the image regardless of the units of IN_FILES data. Conversely, you may enter a very large number (such as 1.0E38) in order to make such pixels white (gray level 255).

(5) BPLANE is the graphics plane containing a blotch of the area(s) of interest. If the number is positive, images will be generated for the area(s) inside the blotch; if the number is negative, the area outside the blotch will be generated as an image. For these cases, the blotch must already be resident in the graphics channel of the display unit and, along with its sign (+ or -), must correspond to the one used when the IN_FILES data files were generated. If IN_FILES represents a full image (i.e., it was generated using a full-image blotch or option), a "0" should be entered for BPLANE. In this case, a blotch need not be resident in the display unit as a full image will automatically be generated.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Box Size | List Channels & Images | Turn Graphics Plane(s) On/Off | Remove Colors (This Channel) | Exit |
| 2 | Show MIN/MAX, MEAN For Box | Show MIN/MAX For Image | Input MIN/MAX To Rescale | Histogram (Current Image) | |
| 1 | Display Another Channel | Process New Input File | Save Displayed Image | | |

A1: This button enables the user to switch to another refresh memory. One will be prompted for the parameter NEW_CHAN which is the channel number, or refresh memory, whose image you wish to display. A value in the range 1 to 14 should be entered. If a null value "--" is entered for NEW_CHAN, no action will be taken and the button options will be reactivated. If the image in this channel was not generated during this session of STATDIS, i.e. it was not one of the IN_FILES, one will be prompted for the name of the real-numbered data file from which it was generated (or for a null value "--" entry to reenter another channel number). If this data file cannot be opened, you will be asked to enter another channel number. The parameter inputs for this situation are IN_NAME, MODE and INVAL. IN_NAME is the name of the real-numbered data file from which the image in the requested channel was generated. As with IN_FILES, the data file must have been generated by a SEAPAK proc (e.g., DERIV, ADDF) using the blotch currently residing in the graphics plane BPLANE or, if BPLANE=0, for a full image. One may enter a null value "--" (the default value) instead to choose another channel. If you enter the null value again when a new channel number is requested, the image which had been displayed before pressing button A1 will be redisplayed. The extension ".DAT" will be used by default if it is omitted from the file name. MODE and INVAL are the same as defined above.

A2 Depressing this button enables the user to display on the terminal the min/max, mean and total valid pixels within the box shown on the IIS. This button is not available when MODE=2.

A3: This button enables the user to change the box size. Each time the button is depressed, the box size changes to the next

size in the following sequence: 7x7, 15x15, 31x31, 63x63, 31x31, . . . ,3x3, 7x7, etc. This button is not available when MODE=2.

B1: Another input file can be processed by depressing this button. The user is prompted with all the parameters that are initially input except BPLANE, i.e. IN_FILE (only one), CHAN, INVAL and MODE. It is required that the new IN_FILE has been generated with the same blotch that the original input files used. If a null value "--" is entered for IN_FILE, no action will be taken and the button options will be reactivated. If an incorrect name is entered (i.e., that file cannot be opened), one will be requested to enter IN_FILE again. If one enters a value for CHAN that is a channel which is already occupied with an image generated during this STATDIS session, the user will be prompted again for a channel number. If the same channel number is entered again, the newly generated image will replace the previous one which will be lost unless it was saved to a disk file using button C1. For the first CHAN request after pressing button B1, the null value is the default. For any subsequent requests, the previous entry becomes the default value.

B2: The current min/max scaling for the displayed image as well the original scaling are displayed to the terminal when this button is used. This button is not available when MODE=2.

B3: This button allows the user to display on his/her terminal a list of the images in all the refresh memories of the IIS.

C1: This button enables the user to save the currently displayed image to disk. Two parameters are requested as input, OUT_FILE and DELETE. OUT_FILE is the disk file name under which to save the currently displayed image. If one wishes to save an image from a channel other than the one displayed, first switch to that channel by using button A1. The name for OUT_FILE cannot be exactly the same as that of the data file used to generate the image being saved (this can be checked by pressing button B3). If a null value "--" (the default value) is entered, no action will be taken and the button options will be reactivated. The extension ".IMG" will be used by default if it is omitted from the file name. DELETE indicates whether or not to delete the real-numbered data file used to generate the currently displayed image. A YES or NO should be entered for this parameter. Again, if a null value "--" (the default value) is entered, no action will be taken and the button options will be reactivated. If the real-numbered data file is deleted, the displayed image will no longer be available for rescaling and the next available channel will be displayed automatically. If no image is available in the other channels at this point, the proc will terminate. Recall that the disk space required by a data file is proportional to the blotch area and may be much more than that required by an image file which is always 513 blocks. For a full image (BPLANE=0, the equivalent of a full-image blotch), a data file will require 2049 blocks or about four times the space of an

image file. For a blotch covering less than a quarter of the image, however, the data file will be smaller than an image file. Thus, this option may allow you to save substantial amounts of disk space by deleting the data files (especially large ones) for images which have been rescaled to your satisfaction.

C2: A new range for scaling the image can be input with this button when MODE=1. Three parameters are required to be defined INVAL, MIN and MAX. INVAL is the same as defined under PARAMETERS. MIN defines the lower end of the range of pixel values which will be rescaled for the displayed image. Pixel values which are less than or equal to MIN will be set to "black." The value entered should conform to the units of the image (i.e., gray levels or other linear scales). The value of MIN must be less than that of MAX. The current image minimum is used as the default value of MIN. If a null value "--" is entered, no action will be taken and the button options will be reactivated. You may use buttons A2 (box min/max), B2 (image min/max), and D2 (histogram) for help in choosing an appropriate MIN value for rescaling. The processing time for rescaling may be one minute or longer. MAX defines the upper end of the range of pixel values which will be rescaled for the displayed image. Pixel values which are greater than or equal to MAX will be set to "white." Again, the value entered should conform to the units of the image. The current image maximum is used as the default value of MAX.

C3: This button acts as a toggle on the specified graphics planes, i.e. turns off those that are on and on those that are off. One parameter is requested: GPLANES corresponds to the number of the graphics planes one wishes to turn on or off. There are seven available planes numbered 1 to 7 which may be specified in any order. Specified planes which are currently on will be turned off while those that are off will be turned on. "off" means that the plane will be made blank (not erased), while "on" means that it will be reassigned to the color it had at the start of this session and will reappear if it had been turned off. Therefore, you must make sure that the color of a plane you wish to use was not 'OFF' initially. See procs GRPINTL and INT for initializing graphics planes. If all values are null, "--", no action will be taken and the button options will be reactivated.

D2: A histogram of the presently displayed image with the current scaling can be obtained with the aid of this button when MODE=1. The user is prompted with two parameters, RANGE and HISPLANE. RANGE consists of two values which define the range for the pixels to use when calculating the histogram. The RANGE values should conform to the units of the image (i.e., gray levels or other linear scales). RANGE values outside the image's current minimum and maximum (the default values for RANGE) will be ignored. If a null value "--" is entered, no action will be taken and the button options will be reac-

tivated. HISPLANE is the number of the graphics plane on which to plot the histogram. Any plane from 1 to 7 may be used except the one (if any) on which the blotch used to generate the image is drawn. If a histogram (or any other graphics) exists on the plane, it will be deleted before the new one is plotted. The first time this option is used, the default value is the blotch graphics plane number (BPLANE) plus one. Subsequently, the previous HISPLANE entry becomes the default. This option may be used to retain up to six histograms at one time for comparison. Button C3 may be used to toggle any of the graphics planes on/off. Note that generating a histogram is much faster than rescaling an image which may require a minute or more of processing.

D3: This button resets the color lookup tables being used back to a gray scale. This button must be used before a histogram is generated with button D2. This button is not available when MODE=2.

F3: This button terminates the current proc.

**PROGRAM NAME:** STRETCHT
**DATE:** 4/15/91
**MENU:** LUT

**DESCRIPTION:** The program STRETCHT provides contrast stretching capability for images on the IIS display. The trackball is used to control the stretching, i.e. the range of both the input pixels and the output gray levels. When one moves the cursor left or right, the pixel verses gray level curve is translated left or right, respectively. When the cursor moves up or down, the slope of the curve increases or decreases, respectively. Contrast stretching within or exterior to blotch planes are also allowed. Up to two blotching planes can be specified. A picture negation option is also included. Note that this program is different from CURMOD in that blotch planes can be used to limit the area of enhancement, and that the input and output range of values can assume any values within [0,255].

**PARAMETERS:**

(1) PLANES defines the graphics planes used in the contrast stretching processing. The number of values specified should be equal to the number of channel(s) being displayed plus 2. All the graphics planes specified will be blanked automatically and used to store the stretch mapping graphics.

(2) BLOTCH designates the graphics planes which define the areas of interest. Up to two graphics planes can be specified. A positive value indicates the region inside the blotched plane. A negative value indicates a region outside the blotched plane. A value of zero is used when no blotch planes are being employed.

(3) OPTION is a parameter which is used only when two blotching planes are specified. It defines the region of interest relative to these two planes by specifying it as an "AND", "OR" or "XOR" combination of the original blotching planes. The "XOR" is an "exclusive or" which means that the region of interest will be all of the two original regions except the intersection.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Bands | Toggle Function Display | Negate Picture (A Toggle) | Independent Band Transform (A Toggle) | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: If the original image is a composite of three bands, one on each gun, one can cycle among the bands and modify the LUT associated with each by the use of this button.

B3: This button toggles the pixel value/gray level graph on or off.

C3: Inverting the picture, i.e. changing the pixel value verses gray level curve from a positive slope to a negative slope and vice-versa is achieved with this button.

D3: This button selects the option to modify the LUT's of multiband images one band at a time.

F3: Depressing this button terminates the program and returns the user to SEAPAK.

**PROGRAM NAME:** SURFBLK
**DATE:** 4/15/91
**MENU:** MISCLIST

**DESCRIPTION:** This program allows the creation of blanking and/or boundary files corresponding to a group of 1-50 ASCII files in a format compatible with the Surfer software of Golden Software, Inc. It is assumed these files have been created by either SEAPAK programs ASC2GEM or ASCTRANS (or with a spreadsheet and put in a form identical to that created by either of these). The blanking files are used along with Surfer's GRID module to create "holes" in a cross section plot at locations where the data are missing. The boundary files are used within Surfer's TOPO module to draw a bottom depth contour on the cross section plot. The Navy 5-minute resolution digital bathymetry database is used for obtaining the bottom depth values. A wildcard file specification is acceptable for the input Surfer files. The output blanking files will have the same name as each input file, with "_G.BLN" (for GRID blanking file) appended to the name. An output boundary file will have "_T.BLN" (for TOPO blanking file) appended to its name. The user must specify the columns in the input file(s) containing X, Y and Z for the output section. These columns will be read in creating the blanking/boundary files. Defaults are provided for these values based on Surfer files created by either SEAPAK programs ASC2GEM or ASCTRANS. Since the X axis value may not always be latitude or longitude (it could be distance or possibly just sequential profile number), an additional parameter is provided for specifying the latitude/longitude at each profile along the section. This is used when a boundary file is requested, in order to read the bathymetry database and determine the bottom depths at each profile location. Lastly, the user must specify the missing data code in the input file(s) if they are requesting a blanking file.

**PARAMETERS:**

(1) SRFASC is a list of up to 50 input Surfer-format ASCII files. A wildcard is acceptable and must be specified in SRFASC(1), in which case all other inputs for SRFASC are ignored.

(2) INTYPE is the type for the input Surfer ASCII file(s). Specify a value of "1" to indicate that all of the files were output by SEAPAK program ASCTRANS or are in its format, or a value of "2" to indicate that all of the files were output by SEAPAK program ASC2GEM or are in its format. ASC2GEM creates sections ordered by profile (i.e. all depths for profile 1, followed by all depths for profile 2, etc.), while ASCTRANS creates sections ordered by depth (i.e. all profiles for depth 1, followed by all profiles for depth 2, etc.).

(3) FLAG is the file creation flag. Specify a value of "1" to create a blanking file only, or a value of "2" to create both blanking and boundary files for each file specified in SRFASC.

(4) XCOL is the starting column number, width and number of places after the decimal for the X axis. Number of places after the decimal is ignored for integer data; specify FORMAT(1)=3 in this case. Typically X represents either distance or profile number. For ASCTRANS output (INTYPE=1), XCOL=(7,11,5) are the values to use. For ASC2GEM output (INTYPE=2), XCOL=(10,2,0) are the values to use.

(5) YCOL is the starting column number, width and number of places after the decimal for the Y axis. Number of places after the decimal is ignored for integer data; specify FORMAT(2)=3 in this case. Typically Y represents depth. For ASCTRANS output (INTYPE=1), YCOL=(43,11,5) are the values to use. For ASC2GEM output (INTYPE=2), YCOL=(18,4,0) are the values to use.

(6) ZCOL is the starting column number, width and number of places after the decimal for the X axis. Number of places after the decimal is ignored for integer data; specify FORMAT(3)=3 in this case. Z is the data to be contoured on the Surfer-generated section. For ASCTRANS output (INTYPE=1), ZCOL=(55, 11,5) are the values to use. For ASC2GEM output (INTYPE=2), ZCOL=(26,6,3) are the values to use.

(7) FORMAT is the format for XCOL, YCOL and ZCOL respectively. Specify a value of "1" to indicate a floating point format, "2" to indicate an exponential format, and "3" to indicate an integer format. These values determine how the data in the input file are to be read. For ASCTRANS output (INTYPE=1), FORMAT=(2,2,2) are the values to use. For ASC2GEM output (INTYPE=2), FORMAT=(3,3,1) are the values to use.

(8) LATITUDE are the latitude locations for profiles on the section. This input is only used for FLAG=2 (boundary file creation). Up to 50 values of LATITUDE can be specified. IMPORTANT: for a long straight section just two latitude values would be necessary to define its endpoints, and the program will produce a boundary file for this case. However, the result will be more accurate the more intermediate points along the section (ideally as many points as there are profiles along the section) are provided in LATITUDE. Note that all of the files in SRFASC must contain profiles that are co-registered in latitude/longitude space, since the same boundary file will be produced for each SRFASC (with the naming convention for each consistent with the corresponding name in SRFASC).

(9) LONGITUDE are the longitude locations for profiles on the section. This input is only used for FLAG=2 (boundary file creation). Up to 50 values of LONGITUDE can be specified. IMPORTANT: for a long straight section just two longitude values would be necessary to define its endpoints, and the program will produce a boundary file for this case. However, the result will be more accurate the more intermediate points along the section (ideally as many points as there are profiles along the section) are provided in LONGITUDE. Note that all of the files in SRFASC must contain profiles that are co-registered in latitude/longitude space, since the same

boundary file will be produced for each SRFASC (with the naming convention for each consistent with the corresponding name in SRFASC).

(10) MISCOD is the missing data code, to be used in creating the Surfer blanking file for each input file SRFASC. MISCOD applies to all input files specified by SRFASC, and must be EXACTLY what appears in the Surfer ASCII file in order for blanking to be done correctly.

**IIS BUTTON DEFINITIONS:**

No buttons are required in this program.

**PROGRAM NAME:** SURFSCT
**DATE:** 4/15/91
**MENU:** GEM4LIST

**DESCRIPTION:** This program allows you to convert up to 50 GEMPAK4 SNLIST ASCII files (each with a group of profiles defining a cross section) to an ASCII format the PC Surfer package by Golden Software, Inc. will recognize. The output file corresponding to each input file will contain the same data columns (i.e depth, temperature and possibly others) but will have two additional columns at the start of each output line: STNM from the input file (station name) in column 1 and distance in kilometers along the section in column 2. Note that the output file, for maximum compatibility with Surfer, will have no header lines so the user must note the ordering of the data columns. When the output file is brought into Surfer, the user should specify column B as the "X" (distance) column, column C as the "Y" (depth) column, and columns D and on as the "Z" (data) column.

The profiles in the SNLIST output should be ordered along the desired section since SURFSCT will maintain this order in computing distances along the section. The user can explicitly specify the stations they want along the section, in the proper order, from within SNLIST. For further information on using SNLIST, see the GEMPAK version 4 User's Guide. For further information on incorporating the output file into Surfer, see Golden Software's Surfer documentation.

**IMPORTANT NOTE:** SURFSCT assumes that the INASC file(s) have stations in the order they fall along the section. GEMPAK version 4 orders the stations consecutively by station number within the SNLIST file, so the user will need some other means to re-order the SNLIST file if their section contains station numbers which don't increase continuously (one way is with a script file which runs SNLIST one station at a time and appends the output to a master ASCII file).

**PARAMETERS:**

(1) INASC is a list of up to 50 input (i.e. SNLIST output) files to convert (see "IMPORTANT NOTE" above). These files will be processed in sequence. If there is an open or read error for any one, it is skipped (and the converted file OUTASC will be truncated if it was being written) and the next one is processed.

(2) OUTASC is a list of up to 50 output (i.e. Surfer section format) files. The files will be written in sequence. If there is a open or write error for any one, it is skipped (and the file will be truncated if it was being written) and the next one is processed.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** SWITCHG
**DATE:** 4/15/91
**MENU:** UTILANL

**DESCRIPTION:** Use this program to allow access to running GEMPAK4 programs after entering the SEAPAK menu. The corresponding program SWITCHS is used to switch back to access of SEAPAK programs after running SWITCHG (SWITCHS is not necessary upon entering SEAPAK's menu initially).

**PARAMETERS:**
No parameters are required in this program.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** SWITCHS
**DATE:** 4/15/91
**MENU:** UTILANL

**DESCRIPTION:** Use this program to allow access to running SEAPAK programs once again after gaining access to the GEMPAK4 programs from the SEAPAK menu (using SWITCHG). SWITCHS is not necessary upon entering SEAPAK's menu initially.

**PARAMETERS:**
No parameters are required in this program.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this program.

**PROGRAM NAME:** TABLOAD
**DATE:** 4/15/91
**MENU:** COLOR

**DESCRIPTION:** The proc TABLOAD loads disk-resident IIS look-up tables (LUT's) onto a user-specified refresh memory. The disk-resident LUT's would have been previously saved using TABSAV or PAINT. Several IIS memory planes can be loaded at the same time.

**PARAMETERS:**

(1) FILENAME is the name of the file containing the LUT to be loaded. The file specified should be one that was generated by either PAINT or TABSAV. The extension ".LUT" will be used by default if it is omitted. If "--" is entered, a linear, black and white LUT will be loaded.

(2) CHANNEL defines the number of the refresh memory whose look-up tables are to be loaded. This parameter accepts up to 10 values, each of which corresponds to a channel whose LUT one desires to change. The acceptable values are:

```
-1 -- load LUT into all memories (default)
 1 -- load LUT into memory 1
 2 -- load LUT into memory 2
 .
 .
 .
14 -- load LUT into memory 14
```

Examples:

CHANNEL=(1,2,3) loads the LUT into channels 1,2, and 3
CHANNEL=5 loads the LUT into channel 5

**IIS BUTTON DEFINITIONS:**
No buttons are utilized in this proc.

**PROGRAM NAME:** TABSAV
**DATE:** 4/15/91
**MENU:** COLOR

**DESCRIPTION:** The proc TABSAV saves a user created IIS lookup table (LUT) on disk with the filename input. The LUT saved is the one currently residing on the specified refresh memory. The procs TABLOAD, PAINT and COLBAR can be used to recall and load a saved LUT file.

**PARAMETERS:**
(1) FILENAME is the output host-file name of the LUT to be saved. The extension ".LUT" will be used by default if it is omitted.
(2) CHANNEL is the number of the refresh memory whose look-up table is being saved to disk. The value of this parameter can be from 1 to 14. For example, CHANNEL=5 will cause the lookup tables associated with memory 5 to be saved on disk.

**IIS BUTTON DEFINITIONS:**
No buttons are required by this proc.

**PROGRAM NAME:** TAPUTL
**DATE:** 4/15/91
**MENU:** GENUTIL

**DESCRIPTION:** TAPUTL is a tape utility proc which allows one to:

(1) initialize a tape with a label,
(2) write to a tape in a VAX copy format, i.e. make a copy tape,
(3) read from a copy tape,
(4) list the contents of a copy tape,
(5) write to a backup tape in a VAX saveset format, i.e. make a backup tape,
(6) read selected files from a saveset of a backup tape,
and (7) list the contents of a saveset of a backup tape.

This utility is designed to help the user who is not familiar with the DCL command BACKUP to accomplish the task of archiving their data sets. More detailed information can be found in the DEC Utilities Manual.

**PARAMETERS:**

(1) TAPE identifies the tape drive being used for the archiving. Five tape drives are currently available to the user. Enter a value of 0 for tape drive MFA0:, 1 for MFA1:, 2 for MSA0:, 3 for MTA0:, and 4 for MTB0:.

(2) TYPE specifies whether one is making a COPY tape ( enter a value of 1 ) or a BACKUP tape ( enter a value of 2 ). Archiving is most effectively performed using the BACKUP tape specification since that operation has more careful error checking.

(3) DENSITY selects the tape density one wants to use. MSA0: is limited to 1600 bpi only, while the others can be either 1600 or 6250 bpi.

(4) MODE specifies the function one is trying to perform on the tape. If one is initializing the tape, enter a value of 1. Note that initialization must be done when the tape is new, or is one that can be scratched, i.e. no useful data is presently stored on it. If one wants to write to tape, enter a value of 2. A list of the files written to the tape will be automatically stored under a file named by the parameter LISTFIL. A value of 3 is entered to read data from the tape. When one wants to generate a list of the data files on an existing tape, enter a 4.

(5) FILENAME is the name of the file(s) to read or write. The filename can include wildcards in its specification. Some examples of filenames are:

```
USER:[JONES]
*.*;*
SCRATCH:*.IMG;*
SCRATCH:[JONES]TEST.FIL
```

[JONES]ATL*.*

If the MODE is "list", enter the file name to list only if the tape TYPE is a Copy tape. This parameter is ignored for tape initialization and Backup tape listing ( the whole SAVESET is listed for a Backup tape listing ).

(6) SAVESET is the name given to the set of data stored under BACKUP. Multiple SAVESET's can be saved on a tape, each having its own unique set name.

(7) OUTFILE is the name of the file or directory to which the data from the tape will be transferred. This parameter is valid only for MODE 3.

(8) LABEL is the name with which the tape will be initialized. This parameter is used only in MODE 1, tape initialization.

(9) LISTFIL is the file name that contains the list of files requested with MODE = 4 ( List Option ) or when writing to the tape ( MODE 2 ) under the BACKUP option. This file may then be dumped to the screen using the DCL command TYPE or to the printer using the DCL command PRINT.

**COMMAND SUMMARY:**

| MODE | REQUIRED PARAMETERS | | |
|---|---|---|---|
| 1. Initialize | | | |
| Copy tape | LABEL | | |
| Backup tape | LABEL | | |
| 2. Write | | | |
| Copy tape | FILENAME | | |
| Backup tape | FILENAME | SAVESET | LISTFIL |
| 3. Read | | | |
| Copy tape | FILENAME | OUTFILE | |
| Backup tape | FILENAME | SAVESET | OUTFILE |
| 4. List | | | |
| Copy tape | FILENAME | LISTFIL | |
| Backup tape | SAVESET | LISTFIL | |

**IIS BUTTON DEFINITIONS:**

No buttons are used.

**PROGRAM NAME:** THRES
**DATE:** 4/15/91
**MENU:** CZCSL2

**DESCRIPTION:** This process 'flags' or reassigns a certain range of gray levels in an input image to a specified gray level. Options are provided to alter the range and the output or 'flag' gray level. It is useful in determining the land/cloud (level 1, band 5) and cloud overlay (level 1, band 1) thresholds to be used in the level 2 generation programs. The program is especially useful when a band 5 image has thin clouds which should be excluded from the analysis by enabling the user to display the range of flagged gray levels. Note that the convention used for the LANCLD and CLOUD parameters in the level 2 programs is exclusive meaning that all values exceeding their input values will be flagged. The programs LANCLD and FLAGLC use the same convention. THRES uses an inclusive convention in the RANGE parameter. The program requires the original level 1 image be loaded in one refresh memory and the resultant image will be displayed in another refresh memory.

**PARAMETERS:**

(1) CHAN is the refresh memory in which the original image is loaded in (1 - 14).

(2) OUTCHN is the refresh memory which will be displayed showing the output product (1 - 14, not CHAN).

(3) RANGE refers to all values (inclusive) that are to be reassigned to a single value, GRAY. THRES supports only one continuous input RANGE at a time.

(4) GRAY refers to the gray level (0 - 255, one value) that all values in RANGE will be displayed.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Change Range | Change Gray Level Mask | Toggle Input/ Output Display | | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: Change the range of gray levels to be assigned to the GRAY value.

B3: Change the value of GRAY.

C3: Toggle between CHN and OUTCHN.

F3: Exit THRES.

**PROGRAM NAME:** TIMENV
**DATE:** 4/15/91
**MENU:** GRIDANL

**DESCRIPTION:** This program allows one to plot up to a 10,000-point time series of environmental data from CDF's (Common Data Format) or previously generated ASCII files, by specifying the latitude/longitude point(s), time interval(s) and data type. Up to 4 plots, chosen from a group of over 30 possible plots, can be displayed on a screen at one time. On the IIS, latitude/longitude input can be specified by moving the cursor to a point on an image residing in the refresh memory and depressing an IIS button. The program uses a generalized graphing routine which plots any missing data along the x (time) axis and connects the non-missing data with line segments. The time series need not be of the same data type, time period, latitude/longitude or color as others on the screen - the user is given full flexibility. This program, like the other environmental data programs, runs on any of 5 devices - IIS, Mac, VT240/241, Color Trend (Tek 4105 emulator) or HP plotter. The program can handle raw as well as diagnostic quantities such as Ekman transport, upwelling and surface stress. The program can ingest data residing on a SONY WORM optical drive.

**PARAMETERS:**

(1) MODE specifies the device dependent mode to be utilized in running the program. The allowable values are: "1" for an IIS, "2" for a VT240/241, "3" for a TEK (or a compatible such as the Color Trend), "4" for a Macintosh, and "5" for an HP.

(2) DATES specifies the start and end dates for each plot requested (up to four plots are allowable and thus up to 8 entries may be made). The first value entered corresponds to the start time of the first plot, the second value corresponds to the end time of the first plot, the third value corresponds to the start time of the second plot, the fourth value corresponds to the end time of the second plot, etc. The format is:

YYMMDDHH for CDF data sets.

(3) INCREM is the time increment which will be used for plotting the data points between the start and end times specified in DATES. One value must be entered per plot. The format is:

YYMMDDHH for CDF data sets.

(4) PLOTS specifies the type of plot(s) to be produced. Up to four can be generated at any one time. The acceptable entries associated with the available options are:

30 = Common Data Format (CDF)-derived plot
31 = ASCII file input

(5) COLOR specifies the color number (or graphic plane for an IIS) which is to be used in the plot. One value should be entered

for each plot. The valid ranges for this parameter are 1 to 8 when an IIS is being used, and 1 to 16 when the Tektronix 4105 or compatible terminal is being used.

(6) LAT defines the latitude point for each time series. One must specify a value for each plot. The range is -90 to 90. If one is using an IIS, this parameter can be ignored with the latitude/longitude being subsequently read from the screen using the IIS button D2.

(7) LON defines the longitude point for each time series. One must specify a value for each plot. The range is -180 to 180. If one is using an IIS, this parameter can also be ignored with the latitude/longitude being subsequently read from the screen using the IIS button D2.

(8) SMOOTH is a flag indicating whether or not to apply smoothing to the plot. If the answer is yes, enter a "Y". This means that a mean value will be computed for each primary data point spaced INCREM apart. This mean will be composed of all data points going from INCREM/2 before the primary data point to INCREM/2 after the primary data point. If the answer is no, enter a "N". This means that each primary data point INCREM apart will be plotted.

(9) SONY is a flag indicating whether to mount one or both SONY WORM drives for use in running TIMENV. If the default "--" (null) is entered, the program will not use the SONY. If "0" is entered, drive DIATOM::LDB0 will be mounted. If "1" is entered, drive DIATOM::LDB1 will be mounted. If "2" is entered, both drives DIATOM::LDB0 and DIATOM::LDB1 will be mounted. Any SONY drive mounted will be dismounted automatically when the program terminates.

(10) RUNTYPE specifies whether the user is running the program in "attended" or "unattended" mode. If you specify RUNTYPE="A" (attended), all informational messages, such as the prompt between successive plots, will be sent to the screen. If you specify RUNTYPE="U" (unattended), no informational messages will be sent to the screen. This is designed so that script files with the keystrokes for the run will run without operator intervention in pressing (CR).

**DYNAMIC PARAMETERS:**

After the previous parameters have been selected and "RUN" has been entered, the user may be prompted for more parameters depending upon the choices made and/or IIS buttons depressed when the IIS is being used. The list of these parameters along with their definitions are given below except where they duplicate the above list.

(1) CDBREAK are the wind magnitude break points for drag coefficients, to be used for stress computations. If the null value is kept, a constant drag coefficient (specified in DRAG(1)) is used. Otherwise, either one or two values are input for CDBREAK, and two or three values respectively should be entered for DRAG. The values for CDBREAK should be greater

than 0 (0 is automatically defined as a break point). The values for DRAG will be applied inclusive of each break point in CDBREAK.

(2) CDFNAM is the name of the file with the desired CDF (excluding the file type). The logical names used to denote the directory portion of the CDF file name and the CDF file names themselves are found in Appendix A. For instance, to use the blended CAC SST CDF dataset, the parameter CDFNAM would be set to "CAC:CAC_SST_BLENDED". The file CDF$DAT:ENVDATA.LIST is an up-to-date list of all the environmental datasets, both gridded and non-gridded, and the names of the CDF datasets.

(3) DRAG are the drag coefficient values, to be used for stress computations, when METHOD=2 is specified. Each drag coefficient in sequence will be applied to stress computations for wind magnitudes within the corresponding range defined by the entries of CDBREAK. If the null value is kept for CDBREAK, the value of DRAG(1) is used as the constant drag coefficient.

(4) LEVEL is the CDF level value of type LEVTYP and must be entered if a LEVTYP other than "NONE" is indicated. The units correspond to the LEVTYP, and will typically be in meters (for depth or height) or millibars (for atmospheric pressure)

(5) LEVTYP is the CDF level type mnemonic and must be specified if applicable. One should enter "NONE" when there is no level information in the CDF (i.e. only data at one level). When multi-level data is present in the dataset, specifying LEVTYP="NONE" will extract only the first level (i.e. whatever level is in the first element of the level array).

(6) MAX_DATA is the maximum value along the y-axis. The default value will be the actual value from the data set but this parameter allows the user to scale the plot the way they want.

(7) METHOD is the drag coefficient computation method. This is used for computations using surface stress, including Ekman transport, Ekman upwelling, wind stress curl, and northward Sverdrup transport. METHOD=1 uses the following formulation taken from Large and Pond (1981),

```
Drag = 1.14 * 10**-3 , | U at 10 m | < 10 m/s
Drag = 10**-3 * (0.49 + 0.065 * | U at 10 m |),
            | U at 10 m | > 10 m/s
```

Method 2 uses linear drag coefficient segments, where the wind magnitude break points are specified in CDBREAK and drag coefficients for ranges between the beaks are specified in DRAG.

(8) MIN_DATA is the minimum value along the y-axis. The default value will be the actual value from the data set but this parameter allows the user to scale the plot the way they want.

(9) PARAM is the mnemonic(s) of the CDF variable to be used in the plotting. To obtain a list of mnemonics of a particular CDF, one should run the program CDFLST. Up to four values for PARAM may be entered. When a raw quantity is desired, specify

this in PARAM(1). When a diagnostic quantity is desired, specify the diagnostic mnemonic in PARAM(1), u wind mnemonic in PARAM(2), v wind mnemonic in PARAM(3), and height field mnemonic (if needed for geostrophic computations) in PARAM(4). Possible values of PARAM(1) for diagnostic computations are:

WINDV = total wind vector
WINDGV = geostrophic wind vector
TAUV = surface stress vector, using raw winds
TAUGV = surface stress vector, using geostrophic wind
EKMV = Ekman transport vector, using raw winds
EKMGV = Ekman transport vector, using geostrophic wind
DIV = divergence (1/sec) of raw wind
CURL = vertical component of curl, vorticity (1/sec) of raw wind
DIVG = divergence (1/sec) of geostrophic wind
CURLG = vertical component of curl, vorticity (1/sec) of geos. wind
TAU = total surface stress (N/m**2)
TAUX = E-W surface stress (N/m**2)
TAUY = N-S surface stress (N/m**2)
TAUG = total surface stress (N/m**2) - based on geostrophic winds
TAUGX = E-W surface stress (N/m**2) - based on geostrophic winds
TAUGY = N-S surface stress (N/m**2) - based on geostrophic winds
TAU3 = total surface stress to the 1.5 power (N**1.5/m**3)
TAUG3 = total surface stress ** 1.5 (N**1.5/m**3) - based on geostrophic winds
EKM = total surface Ekman transport (m**2/s)
EKMX = E-W surface Ekman transport (m**2/s)
EKMY = N-S surface Ekman transport (m**2/s)
EKMG = total surface Ekman transport (m**2/s) - based on geostrophic winds
EKMGX = E-W surface Ekman transport (m**2/s) - based on geostrophic. winds
EKMGY = N-S surface Ekman transport (m**2/s) - based on geostrophic winds
EKMD = Ekman depth (m)
UPWEL = Ekman upwelling - based on raw winds (m/s)
UPWELG = Ekman upwelling - based on geostrophic winds (m/s)
WIND = raw wind speed contours (m/s)
WINDG = geostrophic wind speed contours (m/s)
WDDIR = raw wind direction, 0 to 360 degrees
CRLT = curl of total surface stress - based on raw winds (kg/(m**2 * s**2))
CRLTG = curl of total surface stress - based on geostrophic winds (kg/(m**2 * s**2))
NSVT = northward Sverdrup transport - based on raw winds (kg/(m*s))

NSVTG = northward Sverdrup transport - based on geostrophic winds (kg/(m*s))

(10) PTITLE is the title which will be placed on the bottom of the plot. Up to 80 characters may be input. If an ASCII file is generated, the current default value for PTITLE (i.e. before any user changes) is the first line in the file.

(11) TYPE is the component type for stress-related fields. If a value of "1" is entered, the second and third values for parameter PARAM are assumed to be zonal and meridional components of stress, which are present in the requested CDF. Other quantities such as Ekman upwelling and transport could then be derived directly from the stress components. If a value of "2" is entered, the second and third values for PARAM are assumed to be raw surface wind components. In this case, no cyclonic rotation or decrease in magnitude will be applied to the resultant stress vector. If a value of "3" is entered, the second and third values for PARAM are assumed to be geostrophic wind components. In this case, the resultant stress vector will be rotated cyclonically by 15 degrees and decreased in magnitude by 30% to extrapolate it to a surface value.

**IIS BUTTON DEFINITIONS:**
When the IIS is being utilized, the following describes the button functions.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Drop a Scene | Change Channel | | Save/ Restore Graphics Plane(s) | Exit |
| 2 | Draw Plot(s) | Clear Graphics | List Data Values In Time Series | Use Cursor Lat/Lon For Plots | |
| 1 | Change Times, Increment, Smoothing | Change Parameters To Plot | Specify Lat/Lon Point | Change Graphics Color | Toggle To/From HP Mode |

A1: This button allows the user to change the time interval for plotting as well as the increment between points and whether or not to smooth. The user is prompted for the parameters DATES, INCREM and SMOOTH.

A2: The plot(s) for the selected parameter(s) will be drawn when this button is depressed. One is given the option before the

plot is drawn, however, to add a title (PTITLE), and rescale the y-axis (MIN_DATA and MAX_DATA).

A3: A new image may be displayed on the IIS with this button. The program IMAGE is called and its parameters are described in that section.

B1: This button allows the user to change the type of plots being generated. The parameter PLOTS is updated.

B2: All the graphics planes are cleared by this button.

B3: This button enables one to select a different IIS refresh memory. The program SELECT is called. See that section for a description of the parameters.

C1: Using this button, one can specify a new latitude/longitude as the location for the data set to plot. New values for LAT and LON must be entered.

C2: The data retrieved for the plot(s) can be output to the terminal, printer or a file. The user is prompted with the parameter DEST and should enter a "T" for terminal output, a "P" for printer output, and an "F" for file output. Up to three choices for DEST can be entered at one time. FILENAME is the name of the output file which will be generated when DEST includes an "F".

D1: This button enables the user to change graphics colors. The parameter COLOR is requested.

D2: Instead of entering values for latitude/longitude manually, the user can select a location from an image (which has been displayed using button A3) with this button. After depressing button D2, the user is prompted to move the IIS cursor to the desired location on the image and then depress the button again (once per plot requested).

D3: This button calls the program BPSAV which enables the current graphics planes to be saved or restores a previously generated set. The parameters requested are FILE and FLAG which are described in that program's section.

F1: This button enables the user to toggle the plot output to the HP plotter or back to the device specified by MODE.

F3: This button terminates the current program.

**PROGRAM NAME:** TODISK
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** TODISK is a proc which is used to save an image on an IIS image refresh memory as a disk file. The saved image file will contain 513 blocks, which is the standard image file length for SEAPAK. The first block contains the header from another image, which the user specifies, while the remaining 512 blocks contain image data. The header block is described in DMPHDR.

**PARAMETERS:**
(1) FILENAME is the name assigned to the image file which is being saved.
(2) CHAN is the number of the IIS image refresh memory (or channel) which is to be saved.
(3) HEADER is the name of the image file whose header is to be copied into the header of the file which is presently being saved.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** TOHP
**DATE:** 4/15/91
**MENU:** UTILANL

**DESCRIPTION:** This program allows the user to plot data generated by an environmental data program such as TIMENV or GEMPLOT on an HP7550A pen plotter. It does this by first converting a journal (keystroke) command file generated by an environmental data program into one specifically for producing output on the HP7550A pen plotter. This command file then generates a plot file which is kept in the current default directory, and is called HP.PLT. This in turn sends the output to HPLOTQ, the queue for the plotter. Before running this program, one should be sure that the proper media type and size is loaded on the HP plotter, that the plotter is on, and that the desired pens are loaded in the carousel. Note that a color index of 1 in the original Tektronix file corresponds to pen 1 in the carousel, and so on. It is also unlikely that the color indices will represent the same colors on both the Tek and the HP plotter, since colors on both devices can be varied.

If the plot requires pen or media types/sizes different from the current setup, it is suggested that the plotter be put in manual feed mode sometime before the plot reaches the top of the queue (this is done by hitting the "AUTO FEED" button on the keypad until there is no asterisk present on the LED display below the button). If it is left in auto feed, one will not have a pause for making the required changes before the plot begins. When the plotter is in manual feed, one will need to press the "LOAD/UNLOAD" button when prompted on the LED display each time a new plot starts up. The queue can be checked with the command "show queue hplotq" from DCL. If there are any files in queue, they will be listed with their job ID's and the account which submitted them. If the queue is empty there will be just a one-line response such as :

Terminal queue HPLOTQ, on OCEAN1::TXB2, mounted form HP7550 (stock=DEFAULT)

Be sure to return the plotter to its previous configuration after the plot is finished. The following is a list of media and pens available for the HP 7550A in the Ocean Color room of the Laboratory for Hydrospheric Processes' computer facilities:

Paper: glossy 8 1/2 x 11, non-glossy 8 1/2 x 11, glossy 11 x 17 and non-glossy 11 x 17

Transparency (overheads): 8 1/2 x 11 film

Pens: for paper, two thicknesses are available : 0.3 mm and 0.7 mm; for transparency film, two thicknesses are available : 0.3 mm and 0.6 mm. Colors are black, blue, red, green, yellow, aqua, violet, brown, orange, red-

violet (available in both thicknesses and for both media types)

Pen carousels: 3; 2 for paper pens, 1 for transparency pens. (The carousels for paper pens have an icon of a pen with a "P" inside it at the top of the handle, while the carousel for transparency pens has a "T" at its top. Please be sure that the pens and carousel are of the same type! This is very important, since they are specific in their design)

**PARAMETERS:**

(1) INFILE is the input journal (keystroke) command file generated by an environmental data program which is to be plotted.

(2) OUTFILE is the name of the output journal file converted specifically to send output to the HP plotter.

**IIS BUTTON DEFINITIONS:**

The IIS is not used by this program.

**PROGRAM NAME:** <u>TOTEK</u>
**DATE:** <u>4/15/91</u>
**MENU:** <u>UTILANL</u>

**DESCRIPTION:** This program converts a journal (keystroke) command file generated by an environmental data program such as TIMENV or GEMPLOT into one which is specifically for the Tektronix (Color Trend) terminal. It then runs this file. It should be noted that the color indices used in the original journal file correspond to the colors in the HP pen carousel, and may not correspond to the current color settings on the Color Trend. These settings can be changed interactively with the Menu key (fifth key from the left on the top row of the keyboard). For further information, consult the Color Trend 4100 User's Guide.

**PARAMETERS:**
(1) INFILE is the input journal (keystroke) command file generated by an environmental data program which is to be plotted.
(2) OUTFILE is the name of the output journal file converted specifically to run on the Color Trend terminal.

**IIS BUTTON DEFINITIONS:**
The IIS is not used by this program.

**PROGRAM NAME:** TP2DSK
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** TP2DSK ingests CZCS level-1 scenes from tape into disk files containing the scenes at full-resolution. CZCS calibrated radiance tapes (CRTs) are described in Williams et al. (1985a). Up to six minutes of data can be ingested from a tape. Two types of output files are generated. The .ANC output file stores the navigation information while the .FUL output files store the full resolution binary image information. There are six .FUL output files generated for level 1 data, each one corresponding to a CZCS channel. Due to the storage requirement of these files, one should check the amount of free disk allocation before executing the program. A rough estimation is 25 blocks per scan line. To view the data, use the WINDOW program.

**PARAMETERS:**
(1) TAPE specifies the tape drive number on which the tape is mounted. Each tape drive on the system is labelled and, in SEAPAK, corresponds to an integer $\geq$ 0.
(2) CZCS is used to specify the type of data to be ingested. 1 indicates CZCS level 1 (CRT) data format.
(3) SCENE refers to the number of the first scene to be read.
(4) TOTAL refers to the total number of sequential scenes to be ingested (1 to 3).
(5) FILENAME is the name of the output file name. Numbers beginning with 1 are attached to the file name root (not to the .FUL suffix) for each channel or derived product. For level 1 data, the order is 443, 520, 550, 670, 780 nm and 12 microns. The default file extension is ".FUL" when none is specified.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** TP2IMG
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** TP2IMG is used to ingest CZCS level-1 tape data into image files of 512x512 pixels. CZCS calibrated radiance tapes (CRTs) are described in Williams et al. (1985a). For multichannel data, an image file is generated for each channel with the channel number added at the end of the file name. The program also creates an additional control point file for navigation having the extension ".CTL". Each image file contains 513 blocks (each block is 512 bytes), the first block being header information which may be viewed using DMPHDR.

**PARAMETERS:**

(1) DRIVE is the name of the tape drive (the colon is optional). The tape must be physically mounted and the drive must be on-line; the drive must not be allocated (the DCL "MOUNT" command) to you or to someone else. You should remove the write ring before mounting the tape on the drive in order to write-protect the data.

(2) SCENE is the number of the scene to be ingested. For example, the first scene on the tape is number 1, the second is number 2, and so on.

(3) REDFAC is the reduction factors for the horizontal (along scan) and vertical (along orbital track) directions, in that order. Positive values indicate reduction by subsampling whereas negative values indicate magnification by pixel replication. For example, an entry of (2,2) will create images half as wide in samples and half as high in scan lines as the scene area defined by WINDOW; an entry of (-2,-2) will generate images twice as high and wide. Note that reduction in this sense indicates an increase in geographical coverage while expansion indicates a decrease. Values of -1, 0, or 1 are equivalent and generate images having a one-to-one correspondence of pixels with the tape scene.

(4) OUTNAME is a file name to use as the basis for the names of the output files created by this proc. If a device is not specified, "SCRATCH:" will be used; if the device and the directory are not specified, the user's root (main) directory will be used. The extension ".IMG" will be used by default for the output image files if it is omitted from the file name. The name must be a valid host file name. An index will be inserted prior to the "." of the extension. For example, if OUTNAME = "CZCSIMG", the following files will be created:

```
SCRATCH:[acctname]CZCSIMG1.IMG     >    Channel 1 (443 nm)
SCRATCH:[acctname]CZCSIMG2.IMG     >    Channel 2 (520 nm)
SCRATCH:[acctname]CZCSIMG3.IMG     >    Channel 3 (550 nm)
SCRATCH:[acctname]CZCSIMG4.IMG     >    Channel 4 (670 nm)
SCRATCH:[acctname]CZCSIMG5.IMG     >    Channel 5 (750 nm)
```

| | | |
|---|---|---|
| SCRATCH:[acctname]CZCSIMG6.IMG | > | Channel 6 (11.5 um) |
| SCRATCH:[acctname]CZCSIMG.CTL | > | Navigation control point file. |

(5) WINDOW defines, in conjunction with REDFAC, the area of the tape scene to use for generating the SEAPAK images. WINDOW(1) and WINDOW(3) specify the positions of the first and last samples (data points along scan lines), respectively, to use from each scan line. Note that sample positions are numbered from the start of each scan. Since CZCS data were only collected while the satellite was ascending (flying south to north), sample 1 will be the westernmost sample of each scan. WINDOW(2) and WINDOW(4) specify the first and last scan line numbers to ingest from the scene. CZCS level-1 scenes have a maximum of 970 scan lines corresponding to two minutes of data and a fixed number of 1968 pixels per scan line. Since TPCZCS generates only 512x512 pixel image files, subsampling is required to generate an overview of the scene. Blank pixels on the side margins and lines at the bottom of an image are added if the data do not fill the 512x512 array. An error message is generated if an improper combination of reduction factors and window values is input.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** TPTODK
**DATE:** 4/15/91
**MENU:** ENVIROIN

**DESCRIPTION:** This program's main function is converting NODC data from a tape having variable block size into a disk file with fixed record length so that the data can be further ingested into other disk files for data extraction. Since a tape drive must be used, the program can run only on OCEAN1.

**PARAMETERS:**
(1) DRIVE refers to the tape drive logical name (e.g. MFA0 on the OCEAN1 node of the Laboratory for Hydrospheric Processes' local area Vax cluster).
(2) DENSITY is the tape density (800, 1600, 6250).
(3) REWIND determines if the tape is to be rewound to the load point after the tape read is completed (0 - no rewind, 1 - rewind).
(4) RECLEN is the fixed record length of the output disk file and is determined by the specification of the NODC data records (see NODC Users Guide).
(5) OUTFILE is the output file name.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** TRACK
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc overlays ship/aircraft tracks on the currently displayed CZCS or AVHRR image and allows retrieval of the ship track data as well as the image data along these tracks. Different segments of the ship track (or the full track) can be statistically compared with the image data and plotted on the IIS. The values for both ship tracks and image data can be printed. An option is also provided which allows the user to shift the image or the track to register one to the other. The capability to select a new parameter and/or IIS refresh memory interactively is also provided.

**PARAMETERS:**

(1) TRACK is the ship track file name. The ship track data should conform to the format specified in TRAKIN and should be generated by the procs TRAKIN or ARRAY. The extension ".LIS" will be used by default if it is omitted.

(2) GPLANE defines the graphics planes used by the program. Three integer numbers in the range of 1 to 7 should be entered. The first value corresponds to the graphics plane for ship track locations and marks to define the beginning and end of ship track segments. The second value defines which graphics plane to use for the ship data in the plot (as well as the axes). Finally, the third value specifies which graphics plane is to be used for the satellite image data in the optional plot (the axes also use this plane which means that the axes are a combination of the second and third planes specified).

(3) MODE is the parameter used in the interpretation of the input image file data, i.e. what kind of satellite data is being looked at. The values which can be entered depend on the input image and are:

1 - When the input image file is to be compared in gray level units,
2 - When the input image is in CZCS SST units,
3 - When the input image is in AVHRR SST units,
4 - When the input image is in pigment concentration units,
5 - When the input image is in water radiance units,
6 - When the input image is in aerosol radiance units.

(4) PAR is the parameter in the ship track file to be examined. This corresponds to the headings in the TRACK file.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define Position 1 | Define Position 2 | Define Full Track | On/Off Data Plot | Exit |
| 2 | Erase Last Position | Shift/ Reset Image or Track | Start New Segment | On/Off Ship Track | Display Values On CRT |
| 1 | Zoom | Select New Parameter | Plot Data Values | Select Channel | Output To Printer or File |

A3: When one wants to define a segment of the track to analyze, this button and B3 are used. This button defines (and marks in a graphics plane) the beginning of the segment.

A2: This button erases the last mark.

A1: One may zoom both the image and the ship track by depressing this button.

B3: This button defines (and marks in a graphics plane) the end of a segment of a ship track. This is used in conjunction with A3 to select a limited portion of the total ship track for analyses.

B2: One should use the SHIFT/RESET button to adjust the image and the ship track relative to each other. Input for two parameters are requested by this button:

(1) IMAGE defines whether one wants to shift the image relative to the track or vice-versa. One should enter 'YES' to shift or reset the image with respect to the track or 'NO' to shift or reset the ship track with respect to the image.

(2) RESET specifies whether one wants to reset or shift the image/track. A 'YES' is entered to reset the image or track to its original position on the display or a 'NO' to shift the image or track using the cursor.

B1: A new ship track parameter can be selected by depressing this button. The parameter requested, PAR, is defined as above.

C3: This button allows the user to select the whole track for analyses.

C2: A new ship track segment can be requested by this button. After this button is requested, buttons A3 and B3 are used to define the new segment.

C1: Selecting this button allows the user to plot the ship track data versus the satellite image data on the IIS for either the selected segment or the whole ship track. Various statistics for the ship/satellite comparison are output to the terminal.

D3: The user can toggle the plot on and off using this button.

D2: The user can toggle the ship track on and off using this button.

D1: A different IIS refresh memory can be selected with this button.

F3: This button exits TRACK.

F2: This button allows the user to display on the CRT the ship track and corresponding image values for the selected segment or full track.

F1: The values described in F2 may be output to the printer, an ASCII file or both. The user will be prompted for the destination, DEST. A "P" should be entered if the printer is the output device; an "F" for an ASCII file and a "B" for both an ASCII file and to the line printer. If the output is going to an ASCII file ("F" or "B"), the user is also prompted for the file name, FILENAME.

**PROGRAM NAME:** TRAKIN
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** TRAKIN is a proc that is used to ingest continuous profiles of sea truth data obtained from aircraft or ship tracks. The program can handle several parameters at once assuming that they are collected simultaneously. Currently, the program is setup to handle data from the Airborne Oceanographic Lidar (AOL) and assumes the format of the AOL data with up to six files per tape each having a variable number of records. The program creates an array with the time, latitude, longitude and values of each geophysical parameter arranged along a row and spaced chronologically in columns. The program anticipates a (1x, F10.3, F10.3,...) format. The files generated by TRAKIN are used as inputs to ARRAY and TRACK.

**PARAMETERS:**
(1) MODE refers to the longitude convention used in the input data set. For a range of -180 to 180, use option 1, and for a range of 0 to 360, use option 2.
(2) TAPE specifies the tape drive number on which the input tape is mounted. Each tape drive on the system is labelled and, in SEAPAK, corresponds to an integer $\geq 0$.
(3) TRACK refers to the file number (1-6) on the input tape to be read.
(4) PAR is the list of geophysical parameters that are on the tape. The names of the parameters must be provided in the order they are written on the tape. The latitude and longitude should be designated as LAT and LON ,respectively, in the list, and are stored in units of 1/10 degree. Any parameter on the tape that is not to be read should be designated with a "-" in the list.
(5) FILENAME is the output filename of the data array to be created.

**IIS BUTTON DEFINITIONS:**
No buttons are used.

**PROGRAM NAME:** TSERIES
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc determines the mean, standard deviation and/or coefficient of determination for a time series sequence of images. This data can then be plotted on the IIS image display monitor or the HP 7550 plotter, or listed to the terminal when the program is running in the interactive mode. Only pixels within the specified blotched region and data values within the specified data range are processed. Note that in the interactive mode, the blotch plane must be on the IIS display unit prior to entering the program. Also in the interactive mode, options are provided to support the rescaling of the vertical/horizontal axes, redefining of the blotch plane, redefining the data range, and outputting an ASCII file of the plot data. This program is also designed so that it can be run in a non-interactive (batch) mode. In this case, an output file containing the data is generated. To run in the batch mode, one should follow the normal TAE procedures. For example, use the following command:

SEAPAK>TUTOR TSERIES |RUNTYPE=BATCH|

This puts one in the tutor mode, but when RUN is typed, the job is run in background and SEAPAK is ready to continue with another user request.

**PARAMETERS:**
(1) INFILS are the file names of the input time series. Up to 40 image filenames can be entered. However, since VMS wild card input file format is supported, up to 200 image files can be processed. The extension ".IMG" will be used by default if it is omitted from the file name.
(2) ORBITS consists of two numbers which define the range of orbits over which to process data. The first defines the lowest orbit number and the other the highest orbit number to be used in the processing.
(3) MODE specifies whether to generate a statistics distribution based on gray level values or converted pigment concentration values. One should enter a "1" for gray level or a "2" for pigment concentration.
(4) FACTOR is the linear scale factor. This parameter is used only if MODE=1, implying a linear data-to-gray mapping function for the input image; otherwise, it is ignored. If FACTOR is positive, it will represent the factor by which to divide the gray values of INFILS' pixels in order to convert them into actual data values; if zero is entered, the slope and intercept for this mapping function will be obtained from the file header of the input disk image file. To retain the gray values, enter 1 (the default value); for sea surface

temperature (SST), enter 8; for water radiance data, enter 85; for aerosol radiance data, enter 100.

(5) RANGE is the data range for valid pixel identification. The two values entered should conform to the data units of the MODE specified. Only pixels falling into the specified data range are counted for the statistical calculations. Land/clouds and extremely high/low data pixels can be easily excluded from the statistical calculations by entering proper values for this parameter.

(6) BLOTCH is the name of the blotch file and is used only in the BATCH processing mode. The blotch file name is used together with the blotch graphics plane to define the process the region in the input image files. For INTERACTIVE processing, the blotched region should be previously defined (either by BLOTCH or by BPSAV) and displayed on the IIS display monitor when the program is entered. The extension ".BLO" will be used by default if it is omitted from the file name.

(7) BPLANE is the blotch graphics plane number. A value in the range of 1 to 7 should be entered. In the BATCH processing mode, this parameter together with the parameter BLOTCH define the processing region. Only the region masked by the specified BPLANE is processed. In the INTERACTIVE processing mode, BPLANE alone defines the processing region and should be on the display unit when TSERIES is activated. To display a blotched region, use the proc BLOTCH or BPSAV.

(8) GPLANE designates the two graphics planes that are used for the plots when processing in the interactive mode. The first graphics plane is used to plot the points and axes for the statistics. The second graphics plane is used to plot the annotation.

(9) VALID is the minimum number of valid pixels required before any plot of the statistics will be generated. A valid pixel is a pixel that falls in the specified blotched region and falls in the specified data range.

(10) CHAN is a scratch image channel number (1-14). This channel is used to drop input images one by one to obtain the necessary statistics parameters via IIS display functions. This parameter is used only for interactive processing.

(11) OUTF is the file name for the output statistics. This file name is used for the output save file for the BATCH processing mode. It contains the valid number of pixels, mean, standard deviation and coefficient of determination for each orbit.

**IIS BUTTON DEFINITIONS:**

When the user is running this program in the "batch" mode, no buttons are used. When the "interactive" mode is being utilized, the following button menu definitions are applicable.

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Print | Plot Mean | Define Range | Define Blotch | Exit |
| 2 | Change Blotch Plane | Plot Standard Deviation | Rescale Plot | Define Valid | Save Series |
| 1 | Erase Blotch | Plot Coefficient of Deter-mination | ON/OFF Blotch | ON/OFF Image | Terminal Output |

A1: This button enables the user to erase the current blotch plane.

A2: With this button, the user can change the number of the blotch plane and regenerate the statistics. A value for the parameter BPLANE is requested.

A3: A table containing the valid number of pixels, mean, standard deviation and coefficient of determination for each orbit is printed when this button is depressed.

B1: This button allows the user to generate a plot of the coefficient of determination versus orbit number on the IIS display unit or the HP plotter. The prompt DEVICE designates the output to the IIS display unit if "II" is entered or to the HP plotter if "HP" is entered.

B2: This button allows the user to generate a plot of the standard deviation versus orbit number on the IIS display unit or the HP plotter. Again, the parameter DEVICE is used to designate the output to the IIS display unit if "II" is entered or to the HP plotter if "HP" is entered.

B3: This button allows the user to generate a plot of the mean versus orbit number on the IIS display unit or the HP plotter. Again, the parameter DEVICE is used to designate the output to the IIS display unit if "II" is entered or to the HP plotter if "HP" is entered.

C1: The blotch plane (BPLANE) can be toggled on or off with this button. This enables the user to view the area of interest again or to see the plots without interference.

C2: Either axes of the plot may be rescaled using this button. The two parameters requested are:

1) DIREC defines which axes is to be rescaled. A "1"should be entered to resale the horizontal axes and a"2" for the vertical.
2) AXIS defines the plot range for the axis chosen by DIREC. Two numbers should be entered.

C3: This button enables the user to select a new data range for valid pixel identification. The parameter RANGE is requested and is defined the same as earlier.

D1: This button toggles the image on and off.

D2: This button enables the user to redefine the minimum number of valid pixels required before any plots of the statistics will be generated. The parameter VALID is requested and is defined the same as earlier.

D3: This button allows the user to define or add a new blotch area to the current blotch plane and regenerate the statistics. The button menu for the proc BLOTCH is displayed. When the blotch plane modifications are finished, depressing F3 exits BLOTCH and returns the user to the TSERIES button menu.

F1: This button outputs the statistics to the user's terminal.

F2: This button can be used to output to a file a table which contains the valid number of pixels, mean, standard deviation and coefficient of determination for each orbit. The file name is prompted and the default extension ".LIS" is used if none is entered.

F3: This button exits the user from the proc when in the interactive mode.

**PROGRAM:** UNIGRID
**DATE:** 4/15/91
**MENU:** OVERLAY

**DESCRIPTION:** This proc produces a rectangular grid with latitude/ longitude evenly spaced in the specified graphics planes. This uniform latitude/longitude grid overlay is independent of any image that may be in the current refresh memory. The grid location and range is determined solely from the input.

**PARAMETERS:**

(1) GPLANE defines the graphics planes for the grid and annotation overlay. One should enter two values in the range of 1 to 7 for this parameter. The first value specifies the graphics plane for the uniform grid and the second value specifies the graphics plane for the latitude/longitude annotation. The two values can be the same.

(2) DASH indicates whether one wants solid lines or dashed lines for the grid. One should enter a 0 for solid lines and a 1 for dashed lines.

(3) SP is the starting pixel for the grid.

(4) SL is the starting line for the grid. SP and SL define the upper left corner of the grid.

(5) EP is the ending pixel for the grid.

(6) EL is the ending line for the grid. EP and EL define the lower right corner of the grid.

(7) SLALO is a parameter requiring two values. The first value corresponds to the latitude of the start pixel/start line (SP, SL) of the grid. The second value entered corresponds to the longitude value of the same point.

(8) ELALO also requires two values. The first value corresponds to the latitude of the end pixel/end line (EP, EL) of the grid. The second value entered corresponds to the longitude value of the same point.

(9) DINT defines the latitude/longitude intervals for the grid. Two values are entered for this parameter. The first value specifies the latitude spacing of the grid. The second value specifies the longitude spacing of the grid.

**IIS BUTTON DEFINITIONS:**
No buttons are required in this proc.

**PROGRAM NAME:** VARIOG
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc displays the variogram or autocorrelation diagram (normalized or non-normalized) on the IIS display monitor or HP 7550 plotter for a user defined area of interest. The area of interest can be a line segment, a boxed area or a parallelogram defined within this program on the image currently being displayed. If a line segment is specified, one plot is generated. If a box or parallelogram is specified, two plots are generated, one along the direction of each of the adjacent sides. For the box, this means one plot along the pixel direction and one along the line direction. This program is able to handle pigment and SST (sea surface temperature) data types as well as gray levels for input. The option is also available to output the diagram to the line printer or output the data results to an ASCII file. A few observations should be noted concerning the determination of the variogram and the autocorrelation. For the variogram, the plot/calculation extends to only half of the maximum length (in pixels). For the autocorrelation, the plot/calculation extends to the maximum length. Averaging is performed to reduce the plot size if the plot exceeds 300 points. In the variogram calculation, the variance of a particular lag is obtained by summing up all the valid pixel pairs followed by a division of total valid pairs, i.e. all the pixels are weighted equally. In the autocorrelation calculation, the autocorrelation is obtained line by line with the final autocorrelation obtained by the average of the autocorrelations across lines, i.e. all the lines (in the box or parallelogram mode) are weighted equally. For more information on the mathematical theory behind variograms, see the references at the end of this section.

**PARAMETERS:**

(1) MODE specifies whether the data values represented by the gray levels are linearly related to the gray levels (MODE=1) or are pigment concentrations (MODE=2; mg/m3). If MODE=1, FACT may be used to specify the slope of the linear scaling.

(2) FACT is used only if MODE=1, implying a linear data-to-gray mapping function for the current image; otherwise, it is ignored. If FACT is positive, it will represent the factor by which to divide the gray values of image pixels in order to convert them into actual data values. (A value of 1 will return gray values.) If zero is entered, the slope and intercept for this mapping function will be obtained from the header record of the current image disk file.

(3) BOX defines the method for selecting the image data to analyze. If the region of the image to consider is along a line, a "0" should be entered. If the region lies in a box, a "1" needs to be entered. For a parallelogram, the number entered should be a "2". The specific line, box, or parallel-

ogram will be defined on the currently displayed image by the user via the IIS trackball and button menu once this program is initiated.

(4) FUNC indicates the type of analysis to be performed on the region of interest. A value of 1 to 3 should be entered for this parameter. Enter "1" to display the variogram, a "2" to display the autocovariance diagram and a "3" to display an autocorrelation (normalized autocovariance) diagram.

(5) RANGE is the range of valid data to consider in the analysis. Two values should be entered for this parameter. These values should conform in units to the MODE specified.

(6) GPLANE defines the graphics planes to be used by this program. Three integer values in the range of 1 to 7 need to be entered for this parameter. The first two values specify the graphics planes for the output diagrams, while the third value specifies the graphics plane in which to draw the line/box/ parallelogram.

(7) TITLES is the display title(s) to be used on the diagram(s). The defaults are "Variogram Along Pixel Direction" and "Variogram Along Line Direction."

**IIS BUTTON DEFINITIONS:**

There are four sets of button definitions. A set is required for each of the data collection modes specified by the parameter BOX, i.e. whether the data is along a line, in a box or in a parallelogram, and a set of buttons common to all the modes for outputting the diagrams to the printer, etc. These button sets will be discussed individually. It should be noted that one will only use two of these sets, one of the three dealing with defining a line, box or a parallelogram, and the final common one.

**Buttons for BOX=0, i.e. a line:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick New Vertex | | Draw Last Segment | Erase Last Line Segment | Exit |
| 2 | Erase Last Vertex | | | | |
| 1 | | | | | |

A3: This button allows the user to choose the vertices of a line with multiple segments. After the cursor is moved to the beginning of the line, the button is depressed. The cursor is then moved to the next vertex and the button is pushed again, etc.

A2: This button allows one to erase the last vertex that was marked.

C3: After the beginning and endpoints of any segment are marked using A3, these points must be connected using this button. This defines all the points on this part of the line for the specified analysis. Thus the buttons A3 and C3 are used together to form a line with one or more segments.

D3: If one desires to erase the last line segment for any reason, this button provides that capability.

F3: This button initiates the drawing of the requested diagram for the set of points specified by the line just defined and causes the "common" button menu to be dropped.

**Buttons for BOX=1, i.e. a box or rectangle:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define Upper Left Corner | Define Lower Right Corner | Draw Box | Erase Box | Exit |
| 2 | Erase Upper Left Corner | Erase Lower Right Corner | | | |
| 1 | | | | | |

A3: The upper left corner of the box which defines the region of interest is designated using this button.

A2: The corner defined by button A3 can be erased. This allows the user to relocate the corner.

B3: The lower right corner of the box defining the region of interest is designated using this button.

B2: The corner defined by B3 can be erased with this button.

C3: This button draws the box defined by the two corners marked by A3 and B3 above. This then is the region which will be used for the analysis.

D3: This button erases the box drawn by C3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size of the box.

F3: This button initiates the drawing of the requested diagram for the set of points specified by the box just defined and causes the "common" button menu to be dropped.

**Button definitions for BOX=2, a parallelogram:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define First Corner | Define Second Corner | Define Third Corner | Display Parallel-ogram | Exit |
| 2 | Erase First Corner | Erase Second Corner | Erase Third Corner | Erase Parallel-ogram | |
| 1 | | | | | |

A3: The first corner of the parallelogram which defines the region of interest is designated using this button.

A2: The corner defined by button A3 can be erased. This allows the user to change their mind.

B3: The second corner of the parallelogram defining the region of interest is designated using this button.

B2: The corner defined by B3 can be erased with this button.

C3: The third corner of the parallelogram defining the region of interest is designated using this button. These corners can be entered in either a clockwise or counterclockwise direction but consistency is assumed.

C2: The corner defined by C3 can be erased with this button.

D3: This button draws the parallelogram defined by the three corners marked by A3, B3 and C3 above. This then is the region which will be used for the analysis.

D2: This button erases the parallelogram drawn by D3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size or shape of the parallelogram.

F3: This button initiates the drawing of the requested diagram for the set of points defined within the parallelogram and causes the "common" button menu to be dropped.

**"Common" Button Definitions:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Update Parameters, Process | Toggle Image On/Off | Show Pixel Diagram to Screen | Show Line Diagram to Screen | Exit |
| 2 | Plot Pixel Variogram to HP | Save the Graphics to Disk | Output To File Pixel Variogram | Output To File Line Variogram | Print Pixel Variogram |
| 1 | Plot Line Variogram to HP | ON/OFF Box/Line | ON/OFF Pixel Variogram | ON/OFF Line Variogram | Print Line Variogram |

A1: This button sends the line variogram plot to the HP 7550 plotter, using a pen number corresponding to the value specified in GPLANE.

A2: This button sends the pixel variogram plot to the HP 7550 plotter, using a pen number corresponding to the value specified in GPLANE.

A3: This button allows the user to reset all of the initial parameters to this proc. Just as when this proc is invoked, a button menu for defining a line, rectangle, or parallelogram blotch will first be presented. After a blotch is defined, the above menu will be reset.

B1: This button acts as a toggle, turning the display of the region of interest off or on.

B2: This button invokes the proc BPSAV to save or restore graphics and returns the user to this menu.

B3: This button toggles the display image on and off.

C1: This button acts as a toggle, turning the display of the specified diagram in the pixel direction off or on. For a region of interest that corresponds to a line, the diagram is designated as a pixel variogram so this is the button to use to turn its diagram on or off.

C2: This button enables the user to output to an ASCII file the table associated with the points in the diagram for the pixel direction. The user will be prompted for the name of the output file (FOUT). The extension ".LIS" will be used by default if it is omitted from the file name.

C3: This button sends the pixel variogram plot to the terminal.

D1: This button acts as a toggle, turning the display of the specified diagram in the line direction off or on.

D2: This button enables the user to output to an ASCII file the table associated with the points in the diagram for the line direction. The user will be prompted for the name of the

output file (FOUT). The extension ".LIS" will be used by default if it is omitted from the file name.

D3: This button sends the line variogram plot to the terminal.

F1: A printer plot similar to the line diagram displayed on the IIS will be generated using this button.

F2: A printer plot similar to the pixel diagram displayed on the IIS will be generated using this button.

F3: This button terminates the proc.

**PROGRAM NAME:** WINDOW
**DATE:** 4/15/91
**MENU:** INGEST

**DESCRIPTION:** This proc allows the user to roam over a full size (1 x 1 resolution) CZCS scene or a DSP 1024x1024 display image and extract subscenes of interest with a window (i.e. box). The size of the window can be changed interactively to define a subscene with different subsampling reduction factors. The box size is measured in full resolution image pixels, not monitor pixels. The input file should be a full size CZCS disk resident file generated by the program TP2DSK. The output file is 513 blocks in size with the first block being a header record followed by 512 data blocks (512x512 samples). This program always uses channel pairs 1 through 5 (channels 1 and 8, 2 and 9,etc.) to serve the virtual roam function. Channel 5 is used to display the overview and the channel pairs 1 through 4 are used to store the 1 x 1 full resolution image (up to 1024 lines) for the virtual roam. The user should, therefore, be aware that the contents of these channels (i.e. 1-5 and 8-12) will be changed. The parameter ICAS allows the user to roam the full size image in color. If all the above channels are loaded with the same color (via PAINT or TABLOAD) and the ICAS is set to 1, the roam will be done on the colored image. It is recommended to reset the display with the process INT after exiting the program, otherwise a split screen display will appear on the display monitor.

**PARAMETERS:**

(1) INFILE is the file name of the input full resolution CZCS scene. The file should be generated by the process TP2DSK or by the MIAMI DSP system. The extension ".FUL" will be used by default if it is omitted.

(2) GPLANE designates the graphics planes to be used for the window and the "marked" box. One should enter two integer numbers in the range of 1 to 7 for this parameter. The first value defines the graphics plane for the window which is used to roam the full scene. The second value defines the graphics plane on which to "mark" a box if the IIS button D1 is used.

(3) ICAS determines whether or not the pipeline of the IIS is to be initialized (i.e. whether the colors of the display will be reset to black/white). One should enter a "0" to reset the pipeline or a "1" to retain the current color setting. As explained above, this program always uses channel pairs 1 through 5 to serve the virtual roam function. Therefore, the user should be aware that the contents of these channels (i.e. 1-5 and 8-12) will be changed. The parameter ICAS allows the user to roam the full size image in color if all these channels are loaded with the same color (via PAINT or TABLOAD) and the ICAS is set to 1.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Create Disk File For Current Image | Create Disk Files For Sister Images | | Show Subscene Coordinates | Exit |
| 2 | | | | | Roam/ Overview Toggle |
| 1 | Change Horizontal Box Size | Change Vertical Box Size | | Mark Box | Pan Mode Toggle |

A1: This button allows one to change the box size in the horizontal direction. The box is initially 512 pixels in the horizontal direction. When this button is depressed, it increases to 1024, when depressed again it goes to 1536, and finally to 2048 before returning to 512. These pixel values are in full-resolution equivalents. This means that if the original image had 2048 pixels, the initial 512 box will span only one-fourth the width of the scene or 128 monitor pixels.

A3: Depressing this button allows the user to save the section of the current image within the window to a disk file. The user is prompted for the output FILENAME. The default file extension ".IMG" is used if it is omitted from the user's input.

B1: This button allows one to change the box size in the vertical direction. The box is initially 512 pixels in the vertical direction. When this button is depressed, it increases to 1024, when depressed again it goes to 1536, and finally to 2048 before returning to 512.

B3: Depressing this button allows the user to save the section of the current image within the window, along with the corresponding part of its sister images, i.e. the other channels, to a disk file. The user is prompted with two parameters:

INFILE contains the disk file names of the full size CZCS images from which one wants to save the windowed area. These files should have been generated by the program TP2DSK. The extension ".FUL" will be used by default if it is omitted.

OUTFILE contains the names of the outfiles corresponding to INFILE. These will be 512x512 subscenes as defined by the windowed area. Note that the pixel spacing will depend on the size of the window, e.g. a 1024x1024 box

will generate files subsampled by a factor of 2 in both pixel and line directions. A control file with the file extension .CTL will also be generated if these are the first output files requested for the current windowed area. The extension ".IMG" will be used by default if it is omitted.

D1: This button allows the user to mark the current window box in the graphics plane specified by GPLANE(2).

D3: Depressing this button provides the user with the coordinates of the window box. The upper left pixel/line and lower right pixel/line of the box are displayed on the terminal.

F1: When the full resolution scene is being viewed, i.e. F2 has been depressed, the user will get an automatic pan as soon as the track ball is moved. The direction of the pan is determined by the initial direction of the track ball, i.e. left, right, up or down. This button also allows the user to toggle between the pan and non-pan mode.

F2: This is a toggle which allows one to roam over the full resolution scene or see the overview. When one is in the full resolution mode, the scene can be manually roamed (using the track ball) or automatically panned (using button F1).

F3: This button exits WINDOW.

**PROGRAM NAME:** XCORR
**DATE:** 4/15/91
**MENU:** STAT

**DESCRIPTION:** This proc displays on the IIS monitor or the HP 7550 plotter the cross correlation diagram between two images for a user defined area. This area can be a line segment, a box or a parallelogram defined over the region of interest on the currently displayed image. This area is defined by use of the IIS buttons within the program. The data within the area is further screened by excluding any data outside of a range specified by the user in the input. Options are provided to handle pigment and SST (sea surface temperature) data types as well as gray level values.

The plot generated extends to the full maximum length (in pixels). If a line segment is specified, only one plot is generated. If a box or parallelogram is specified, two plots are generated corresponding to the two directions (one in the pixel and one in the line direction for the box or one in each direction corresponding to the two adjacent sides of the parallelogram). The calculation of the cross correlation is done line by line in the box or parallelogram mode of operation followed by a final average across all the lines. The user can also specify a label for each axes of the plots.

**PARAMETERS:**

(1) CHAN specifies the refresh memory numbers of the two images undergoing the cross correlation analysis. Two integer values in the range 1 to 14 should be entered.

(2) MODE specifies whether the data values represented by the gray levels are linearly related to the gray levels (MODE=1) or are pigment concentrations (MODE=2; mg/m3). If MODE=1, FACT may be used to specify the slope of the linear scaling.

(3) FACT is used only if MODE=1, implying a linear data-to-gray mapping function for the current image; otherwise, it is ignored. If FACT is positive, it will represent the factor by which to divide the gray values of image pixels in order to convert them into actual data values. (A value of 1 will return gray values.) If zero is entered, the slope and intercept for this mapping function will be obtained from the header record of the current image disk file.

(4) BOX defines the data collection mode, i.e. whether the region of interest is a line, box or a parallelogram. A "0" should be entered for a line; a "1" for a box ; and a "2" for a parallelogram.

(5) RANGE specifies the valid data range on each of the input images for the cross correlation analysis, i.e. the data to include in the analysis. Four values should be entered for this parameter. The first two values define the range (minimum/maximum) for the first image, while the second two values define the range for the second image. These values should conform to the data units specified by MODE.

(6) GPLANE specifies the graphics plane numbers used for defining the region of interest and the output diagrams. Enter 3 values for this parameter in the range 1 to 7. The first value entered will be the plane used to define the area of interest. The second value will be used for the plane on which to display the cross correlation along the pixel direction. Finally, the third value will be used for the plane on which to display the cross correlation along the line direction. If a line segment is the study area, only the second value (pixel direction) is used to display the diagram.

(7) TITLES provides the labels for the X and Y axes of the cross correlation plots.

**IIS BUTTON DEFINITIONS:**

There are four sets of button definitions. A set is required for each of the data collection modes specified by the parameter BOX, i.e. whether the data is along a line, in a box or in a parallelogram, and a set of buttons common to all the modes for outputting the diagrams to the printer, etc. These button sets will be discussed individually. It should be noted that one will only use two of these sets, one of the three dealing with defining a line, box or parallelogram, and the final common one.

**Buttons for BOX=0, i.e. a line:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Pick New Vertex | | Draw Last Segment | Erase Last Line Segment | Exit |
| 2 | Erase Last Vertex | | | | |
| 1 | | | | | |

A3: This button allows the user to choose the vertices of a line with multiple segments. After the cursor is moved to the beginning of the line, the button is depressed. The cursor is then moved to the next vertex and the button is pushed again, etc.

A2: This button allows one to erase the last vertex that was marked.

C3: After the beginning and endpoints of any segment are marked using A3, these points must be connected using this button.

This defines all the points on this part of the line (that are also within RANGE) for analysis. Thus the buttons A3 and C3 are used together to form a line with one or more segments.

D3: If one desires to erase the last line segment for any reason, this button provides that capability.

F3: This button initiates the calculation and plotting of the cross correlation for the set of points specified by the line just defined (along with the RANGE constraints) and causes the "common" button menu to be dropped.

**Buttons for BOX=1, i.e. a box or rectangle:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Define Upper Left Corner | Define Lower Right Corner | Draw Box | Erase Box | Exit |
| 2 | Erase Upper Left Corner | Erase Lower Right Corner | | | |
| 1 | | | | | |

A3: The upper left corner of the box which defines the region of interest is designated using this button.

A2: The corner defined by button A3 can be erased. This allows the user to relocate the corner.

B3: The lower right corner of the box defining the region of interest is designated using this button.

B2: The corner defined by B3 can be erased with this button.

C3: This button draws the box defined by the two corners marked by A3 and B3 above. This then is the region which will be used for the analysis.

D3: This button erases the box drawn by C3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size of the box.

F3: This button initiates the calculation and plotting of the cross correlation for the set of points specified by the box just defined (along with the RANGE constraints) and causes the "common" button menu to be dropped.

**Button definitions for BOX=2, i.e. a parallelogram:**

| | A | B | C | D | | F |
|---|---|---|---|---|---|---|
| 3 | Define First Corner | Define Second Corner | Define Third Corner | Display Parallel- ogram | | Exit |
| 2 | Erase First Corner | Erase Second Corner | Erase Third Corner | Erase Parallel- ogram | | |
| 1 | | | | | | |

A3: The first corner of the parallelogram which defines the region of interest is designated using this button.
A2: The corner defined by button A3 can be erased.
B3: The second corner of the parallelogram defining the region of interest is designated using this button.
B2: The corner defined by B3 can be erased with this button.
C3: The third corner of the parallelogram defining the region of interest is designated using this button. These corners can be entered in either a clockwise or counterclockwise direction but consistency is assumed.
C2: The corner defined by C3 can be erased with this button.
D3: This button draws the parallelogram defined by the three corners marked by A3, B3 and C3 above. This then is the region which will be used for the analysis.
D2: This button erases the parallelogram drawn by D3. This essentially allows one to go ahead with redefining a different area for analysis. Note that the corners will also have to be erased to change the size or shape of the parallelogram.
F3: This button initiates the calculation and plotting of the cross correlation for the set of points specified by the parallelogram just defined (along with the RANGE constraints) and causes the "common" button menu to be dropped.

**"Common" Button Definitions:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Update Parameters, Process | | Show Pixel Diagram to Screen | Show Line Diagram to Screen | Exit |
| 2 | Plot Pixel Diagram to HP | Save the Graphics to Disk | Output To File Pixel Cross Correlation | Output To File Line Cross Correlation | Print Pixel Diagram |
| 1 | Plot Line Diagram to HP | ON/OFF Box/Line | ON/OFF Pixel Diagram | ON/OFF Line Diagram | Print Line Diagram |

A1: This button sends the cross correlation plot in the line direction to the HP 7550 plotter, using a pen number corresponding to the value specified in GPLANE.

A2: This button sends the cross correlation plot in the pixel direction to the HP 7550 plotter, using a pen number corresponding to the value specified in GPLANE.

A3: This button allows the user to reset all of the initial parameters to this proc. Just as when this proc is invoked, a button menu for defining a line, rectangle, or parallelogram blotch will first be presented. After a blotch is defined, the above menu will be redrawn.

B1: This button acts as a toggle, turning the display of the region of interest off or on.

B2: This button invokes the proc BPSAV to save or restore graphics and returns the user to this menu.

C1: This button acts as a toggle, turning the display of the cross correlation plot in the pixel direction off or on. For a region of interest that corresponds to a line, the diagram is designated as a pixel plot so this is the button to use to turn its diagram on or off.

C2: This button enables the user to output to an ASCII file the table associated with the points in the diagram for the pixel direction. The user will be prompted for the name of the output file (FOUT). The extension ".LIS" will be used by default if it is omitted from the file name.

C3: This button sends the cross correlation plot in the pixel direction to the terminal.

D1: This button acts as a toggle, turning the display of the cross correlation plot in the line direction off or on.

D2: This button enables the user to output to an ASCII file the table associated with the points in the diagram for the line direction. The user will be prompted for the name of the

output file (FOUT). The extension ".LIS" will be used by default if it is omitted from the file name.

D3: This button sends the cross correlation plot in the line direction to the terminal.

F1: A printer plot similar to the line diagram displayed on the IIS will be generated using this button.

F2: A printer plot similar to the pixel diagram displayed on the IIS will be generated using this button.

F3: This button terminates the proc.

**PROGRAM NAME:** ZONE
**DATE:** 4/15/91
**MENU:** DSP

**DESCRIPTION:** This proc outputs, to ASCII files, several ocean productivity related calculations for latitudinal "zones" in a pigment image. A selected latitude range of a pigment image is divided into several zones, each of which has the same constant latitude width. The latitude range for analysis and the constant latitudinal zone width are specified by the user. The pigment of each valid pixel in the input image can be calculated using either the Miami DSP equation:

```
PIGMENT = 10. ** (0.012 * GRAY - 1.4)
```

or the SEAPAK equations:

```
if (GRAY .le. 136) then
     PIGMENT = 10. ** (136 - GRAY) / 98.38
else,
     PIGMENT = 10. ** (GRAY - 136) / 74.17
```

The ocean productivity related parameters that are calculated for output include:

(1) Ntot - the total number of possible ocean pixels in the zone. Land is determined and subsequently excluded through the use of the input parameter LAND.
(2) Nval - the total valid pixels among the ocean pixels. This is defined by the user input parameter GLEVEL. This throws out pixels where no data exists, is cloud covered or outside some reasonable range.
(3) VP - the area for the valid pixels in $10^{6*}$Km**2; VP=Nval*Cos(Lat)*AREAP
(4) TP - the area for the total ocean area in the region of interest in $10^{6*}$Km**2; TP=Ntot*Cos(Lat)*AREAP
(5) PIG - the mean pigment concentration determined from valid pixels in mg/m**3; PIG=SUM(CHLOR)/Nval where the SUM ranges over all Nval and CHLOR is the chlorophyll concentration at a valid pixel.
(6) PP - the mean primary productivity in gmC/m**2/Day; PP= SQRT(PIG)/Nval.
(7) PIGtot - the total pigment in the ocean area of the zone in ktons_pigment/m; PIGtot=PIG*TP
(8) PPtot - the total productivity in the oceanic region of the zone in MegatonsC/day; PPtot=PP*TP
(9) F - is the ratio of new production to total production; F=SUM( 0.26+(0.65*SQRT(CHLOR)/(SQRT(CHLOR)+1.465)))/Nval where the SUM ranges over all Nval and CHLOR is the chlorophyll concentration at a valid pixel.

(10) Sinking Flux - is given in MegatonsC/day; Sinking_Flux=(SUM((0.26+(0.65*SQRT(CHLOR)/(SQRT(CHLOR)+1.465)))*SQRT(CHLOR))/Nval)*TP where the SUM ranges over all Nval.

(11) BP - The mean bacteria calculated from pigment in Mcells/ml; BP=SUM((CHLOR**0.52)+(10**5.96))/NVAL

(12) BP_TOT - The bacteria calculated from pigment for the whole zone in KtonsbC/m; BP_TOT=BP*TP

(13) BPP - the mean bacteria productivity based upon primary productivity in mgbC/m**2/day; BPP=SUM((($10^3$*SQRT(CHLOR))**0.754)*(10**0.101))/NVAL where the SUM ranges over all NVAL and CHLOR is the chlorophyll concentration at a valid pixel.

(14) BPP_TOT - the bacteria productivity based upon primary productivity for the whole zone in $10^5$gmbC/day; BPP_TOT=BPP*TP

(15) ZPP - the mean zooplankton production determined from primary productivity for the zone in mgZC/m**2/day; ZPP=SUM((($10^3$*SQRT(CHLOR))**1.07)/(10**1.26))

(16) ZPP_TOT - the total zooplankton production determined from primary productivity for the zone in tonsZC/day

**PARAMETERS:**

(1) IMGFIL is the input pigment image file name. This image can be either a SEAPAK or a MIAMI DSP pigment image. The extension ".IMG" will be used by default if it is omitted.

(2) OUTFIL1 is an output ASCII file name containing some of the ocean productivity related figures for the specified regions of the input pigment image. It contains some of the values listed in the Description section above. The extension ".LIS" will be used by default if it is omitted.

(3) OUTFIL2 is another output ASCII file name containing some more of the ocean productivity related figures for the specified regions of the input pigment image. It contains some of the values listed in the Description section above, specifically Bacteria derived from pigment, bacteria productivity and zooplankton productivity. The extension ".LIS" will be used by default if it is omitted.

(4) DELIM specifies what will be used for a delimiter between data points. If a "0" is entered a blank will be used (Lotus 1-2-3 expects this); if a "1" is entered a tab will be used (Excel on a Macintosh expects this).

(5) HDRBLK specifies the number of header blocks in the input image file. SEAPAK images always have one block, but Miami DSP images vary.

(6) PIGMENT is a flag indicating whether the pigment image utilizes the Miami DSP or SEAPAK scaling method to convert between counts and pigment. One should enter a "1" for a Miami DSP image and a "2" for a SEAPAK image.

(7) LAND is the range of gray levels which correspond to land. Two integer values in the range [0,255] must be entered with the smaller value first.

(8) GLEVEL is the range of gray levels which are considered to be valid pigment pixels.

(9) EXTREME is the range of latitude in the image file. The northern most value followed by the southern most value need to be entered.

(10) ZONEDEF defines the zones to be used for the analysis. Three numbers must be entered. The first number is the northern most latitude limit for the zones; the second is the southern most latitude limit for the zones; the third is the latitude width for each zone.

(11) COLUMN consists of two numbers defining the east-west extent for the zones. The first number indicates the starting pixel for the zones and the second the ending pixel.

(12) SUM is the start and end zone numbers for summation/averaging of the various output data, zone 1 being the northern most zone.

(13) AREAP is the area per pixel in kilometers squared.

**IIS BUTTON DEFINITIONS:**
No buttons are used in this proc.

**PROGRAM NAME:** ZOOM
**DATE:** 4/15/91
**MENU:** MEMORY

**DESCRIPTION:** The proc ZOOM magnifies the image currently displayed on the IIS (the default) or any other specified refresh memory(ies). Three levels of magnification are obtainable (2, 4 or 8 times the original). While the image is zoomed, one may roam around on the image. The part of the image which is zoomed is centered about the middle of the image as displayed on the IIS at that time.

**PARAMETERS:**

(1) CHANNEL defines the number(s) of the refresh memory(ies) to zoom. The default is zero, and it magnifies the image presently displayed. This parameter accepts up to 16 values, each of which can be a memory number or the special values 0 or -1. The acceptable values are:

```
 0  --  zoom the present display (the default)
-1  --  zoom all memories
 1  --  zoom memory 1
 .
 .
 .
14  --  zoom memory 14
```

For example,

CHANNEL = 6 zooms image memory 6
CHANNEL = (1,5,6) zooms channels 1,5, and 6
CHANNEL = (2,4) zooms image channels 2,4

(2) ZCURSR is a switch which allows the user to turn the cursor on or off. If you use ZCURSR=YES, a small cyan colored cross will be turned on. If you say ZCURSR=NO, no cursor will be displayed. The cursor shows the center of the zoom.

(3) ZGRP is a switch which allows the user to zoom the graphics planes along with the image memory when desired.

"YES" implies that the graphics planes will be zoomed,
"NO" implies that the graphics planes will not be zoomed.

(4) BITPL is the number of the graphics plane used by ZOOM to outline the area zoomed. This is used in conjunction with the "Step back to 1X" button option (button A3). When one is using graphics planes for other plots that one does not want to wipe out, this parameter is important.

**IIS BUTTON DEFINITIONS:**

| | A | B | C | D | F |
|---|---|---|---|---|---|
| 3 | Step Back To 1X | Increment Zoom | Decrement Zoom | | Exit |
| 2 | | | | | |
| 1 | | | | | |

A3: This button allows one to step back to view the original image. When returning to the original, a box is drawn around the area presently being magnified. Pushing button B3 returns one to the same state one was in prior to depressing this button.

B3 Depressing this button causes the image to zoom in increments of powers of two (up to a magnification of 8).

C3: This button allows the user to decrement the zoom by increments of two. The image cannot be decremented below its original magnification, i.e. it does not "shrink" an image.

F3: This button exits ZOOM and returns the user to SEAPAK.

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**15. Supplementary Notes**

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**16. Abstract**

In the 2 years since the publication of Version 1.0 of the SEAPAK User's Guide, significant revisions to the CZCS and AVHRR support and statistical data analysis module have been made and the ancillary environmental data analysis module has been greatly expanded. SEAPAK now has about 200 procedures in the menu. The package continues to emphasize user-friendliness and user-interactive data analyses. Additionally, because the scientific goals of the ocean color research being conducted have shifted to larger space and time scales, batch processing capabilities for both satellite and ancillary environmental data analyses have been enhanced, thus allowing large quantities of data to be ingested and analyzed in background. The continued development of SEAPAK has been paralleled by three other activities that have been influential and assistive: the global CZCS processing effort at GSFC; the collection of oceanographic data sets at NCDS; and the development of PC-SEAPAK. SEAPAK incorporates the final instrument calibration and supports all levels of data available from the CZCS archive.

Volume I of the SEAPAK User's Guide consists of the system description.

**17. Key Words (Suggested by Author(s))**

Ocean Color, Oceanography, Sea Surface Temperature (SST), Image Processing, Coastal Zone Color Scanner (CZCS)

**18. Distribution Statement**

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